Mechanical Ventilation Heat Recovery Unit

climos 150 DC (S)

false ceiling unit

with automatic control unit

Operating Instructions
Please keep next to the MVHR unit!

Status: 01.10

Components suitable for Passive House Dr. Wolfgang Feist

Model:

- climos 150 DC
- climos 150 DC (S) special housing

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0. Introduction

READ THESE INSTRUCTIONS CAREFULLY BEFORE USING THE EQUIPMENT!

This instruction contains all information necessary for an optimal installation of a system and the mechanical ventilation heat recovery (MVHR) unit of the type climos 150 DC. It can also be used as a manual for maintenance and service work.
This instruction teaches you how to use your heat recovery unit in the best way. We recommend calling your installer if any interventions are necessary.

The heat recovery unit is subject to permanent improvement and development, so the heat recovery unit may differ in minor details from this description.

We hope you enjoy your MVHR climos 150 DC.

NOTE: This instruction has been made with the greatest care.However, this introduction confers no rights. We reserve the right to change all or part of the contents of this instruction without prior notice.

1. Brief product description

1.1 Construction

The compact mechanical ventilation heat recovery (MVHR) unit is ready for connection and comprises the heat recovery unit, the control system and the associated control panel. The MVHR is connected to the control system by a 3 meter long cable. The cable which connects the control panel with the control unit may have a max. length of 15 m and has to be provided by the customer, as well as control unit's connection with the power supply.

1.2 Housing, heat insulation, sound insulation

The housing consists of galvanized sheet steel with embedded heat and sound insulation (please refer to appendix A "Dimensions WRG climos" and "Technical Description").
We recommend connecting a silencer to each of the 4 air outlets (especially to supply and extract air outlets or use 1...2 m long soundproofed flex hose Ø160). The air duct connections must be flexible.

1.3 Heat exchanger

The highly efficient counter flow duct heat exchanger (German and European patents) is such that the ducts for the extract and supply air (plastic) are arranged in a checker board pattern, which provides a surface area twice the thermal efficiency of plate heat exchangers; supply air and extract air are hermetically separated from one another.

1.4 Fans

The unit is equipped with two electronically commutated fans (maintenance-free) 48 V DC radial fans with back-bent blades. The specific power consumption is 0,41 Wh/m³ (normal ventilation step); Passiv Haus certificate.

The air flow rates can be varied by the user. Please note that the short presence of just a few number of people means low emission of CO2, humidity and smells into the room air, so it is possible to largely reduce the air flow. Secondary, this avoids a dry room climate when outdoor temperatures are low (dry intake air).

1.5 Filters

The MVHR includes two Z-shaped G4 filters (dust filters). The filters are made of cotton/polyester in a paperboard frame. Optionally, you can use a high-quality supply air pollen filter (filter class F8).

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1.6 Limitations of use

The MVHR has been developed for the exhausting of used air and supply of fresh air. All other use of the MVHR diverts from its intended use, e.g. no too dusty air (sanding dust from parquet floors or plasterboards) may flow through the system. The manufacturer does not assume liability for any damages or consequences resulting from improper use. The MVHR can be used for ventilation in residential and office buildings (with limitations in the industrial sector) at air temperatures up to + 40°C und normal air humidity. Explosive and aggressive gases as well as solvents, which attack the materials of the MVHR, may not be led into the system. The unit has to be installed in a frost-protected room. A ground to air heat exchanger (GHX) is advantageous for preheating the intake air (in winter). If a GHX is not feasible, a defroster heater has to be connected upstream of the unit.

1.7 Frost protection

The frost protection of the unit is realized by monitoring the intake air temperature. The fans automatically stop when t_{INT} < 3°C. The frost protection of an optional connected hot water backup duct heater is assured by monitoring the intake air temperature.
The frost protection of the unit has to be assured by using a:

a) Defroster heater (option), or
b) GHX (option)

1.8 Flammability

The housing consists of sheet steel. The mounting parts are made of flame-resistant styrofoam (flammability class B1). All other components are flame-resistant or normally flammable (heat exchanger, fans); the filter with the paperboard frame (flammable) can be considered a subordinate component. So the unit complies with the building regulations.

2. Options and accessories

2.1 Basic version

The compact mechanical ventilation heat recovery (MVHR) unit comprises the heat recovery unit, the central control unit with power pack und a control panel with display and room temperature sensor.
The control panel enables the user to freely select the minimum, normal and maximum ventilation steps without limitations in time. The ventilation steps can also be stored in 8 independent programs, that can be assigned to the different days of the week, so a fully automatic control with time-dependent alternating ventilation steps is possible. For adapting the MVHR unit to the duct system, the ventilation steps can be changed in 1% increments. The supply and extract air flows are balanced via a coefficient of correction allowing different fan speeds to be adjusted for the same ventilation step. The detailed procedure is described in section 2.5 of the User Guidance of the Automatic Control Unit.
The unit can be switched off manually or via the control panel without disconnecting it from the power mains. This specific switching-off function limits the power input in standby condition to less than 2 W. Furthermore, this automatically provides the necessary frost protection of any downstream hot water backup duct heater.

2.2 Motorised flap for ground to air heat exchanger

If a ground to air heat exchanger (GHX) is installed upstream of the MVHR unit on the intake side, a motorised flap offers the option to take in the outdoor air either via the GHX or directly. Depending on the outdoor temperatures (separate sensor required), the flap is set to air intake via GHX e.g. as follows:

Air intake via GHX at t_{Intake} > 25°C (cooling in summer operation)
Air intake via GHX at t_{Intake} < 5°C (preheating in winter operation)

For all other temperatures (t_{Intake} = 5°C to 25°C), the air is taken in directly (not via GHX). The temperature sensor has to be placed close to the second intake point for recording the outdoor air temperature without being heated by the sun. The sensor is included in delivery with the control unit option “Motorised valve for ground to air heat exchanger”.
The flap hast to be enabled, activated and parameterized via the control unit (see User Guidance of Automatic Control Unit, Section 2.3). The electrical connection of the flap has to be made by the customer according to circuit diagram in appendix 4.3.

Note: When using a GHX , the flap is not obligatory! The flap’s motor has a permanent current consumption of about 50 mA.

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2.3 Constant flow control

The balance between the supply and extract air flows is crucial for proper operation of the system. The air flow balance is established by adjusting the ventilation steps and the correction value. When constant flow control is used, analog flow sensors are used to measure the two air flows, which are balanced by the constant flow mechanism. The advantage is that the constant flow control adapts to changing conditions of the system and is independent from ventilation steps. Fan motor irregularities (motor winding, internal electronics) have no effect on the flow balance.
Two analog flow sensors are needed for constant flow control; they have to be integrated in straight tubes of the same diameter (see Appendix 3.3 and Appendix 4.5).
When setting the parameters, it is possible to store a flow disbalance. The constant flow control has to be activated and parameterised via the control unit in the menu System setup – ventilation steps (see User Guidance of Automatic Control Unit, Section 2.5).

2.4 Brine-defroster / electric frost protection heater

A ground to air heat exchanger / ground to brine to air frost protection, or a temperature-controlled frost protection pre-heater should be used to prevent ice formation on the exhaust side of the heat exchanger. Frost protection is obligatory.

2.4.1 Brine-defroster

Depending on the outdoor temperature (separate sensor required), the pump of the brine-defroster is set as follows:

Pump ON: at t_{Intake} < 0°C (preheating in winter operation)
Pump ON: at t_{Intake} > 25°C (cooling in summer operation)
Pump OFF at t_{Intake} = 5°C to 25°C (no tempering of intake air)

The temperature sensor has to be placed close to the second intake point for recording the outdoor air temperature without being heated by the sun. The sensor is included in delivery with the control unit option “Ground to brine to air frost protection / Motorised valve for ground to air heat exchanger”.
The pump has to be enabled, activated and parameterized (see User Guidance of Automatic Control Unit, Section 2.3). The connection of the pump to the power supply has to be made by the customer according to the circuit diagram in Appendix 4.3a.

2.4.2 Electric defroster heater

To ensure frost protection, the air in the extract-exhaust section of the heat exchanger must not fall below the freezing point. If frost protection is provided by the electric defroster preheater from PAUL, it will adapt automatically to the changing conditions If the temperature of the exhaust air falls below 2°C, the intake air will be pre-heated for so long until the exhaust air temperature exceeds 2°C again. This ensures optimum energy supply and prevents the condensate from freezing. The heater with ohmic heating element has to be installed according to Appendix 4.6.a and the ISO heater with PTC heating element according to Appendix 4.6.b.
The control unit of the MVHR must be equipped for controlling a frost protection heater. The defroster heater has to be activated and parameterised via the control unit in the system setup menu (see User Guidance of Automatic Control Unit, Section 2.1).

2.5 Electric duct heater

Electric or ISO duct heaters can be used as backup heaters for the supply air. They are controlled via the MVHR control system specifically equipped for this purpose. The duct heaters include the prescribed safety appliances. A duct temperature sensor is used to limit the air temperature to 50°C, because higher temperatures would cause dust particles to smoulder (smells). The duct heaters are switched on or off as a function of room temperature, duct temperature and setpoint.
If the room temperature falls below the setpoint, the duct heater will start operating, and will stop when the setpoint is exceeded. The room temperature is recorded by a temperature sensor in the control panel or by an external room temperature sensor.
The setpoint is selected and the heater activated via the control unit (see User Guidance of Automatic Control Unit, Section 2.4). Night economy can also be set. Connections have to be made according to Appendix 2.1, Appendix 3.2, and Appendix 4.4.a for electric back-up duct heaters with ohmic heating element, and to Appendix 4.4.b for ISO back-up duct heaters with PTC heating element.

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Note: Only **one** heating circuit (electric duct heater, hot water duct heater or heating circuit) can be controlled by the control unit!

2.6 Hot water duct heater

A hot water duct heater can be used to heat the supply air. It is controlled via the MVHR control system specifically equipped for this purpose. A duct temperature sensor is used to limit the air temperature to 50 °C, because higher temperatures would cause dust particles to smoulder. The duct heater is switched on or off (hot water circulating pump) as a function of room temperature, duct temperature and temperature setpoint.
If the room temperature falls below the setpoint, the duct heater will start operating, and will stop when the setpoint is exceeded. The room temperature is recorded by a temperature sensor in the programmer or by an external room temperature sensor.
The setpoint is selected and the heater activated via the control unit (see User Guidance of Automatic Control Unit, Section 2.4). A lower night-time temperature can be programmed. Connections shall comply with Appendix 2.1, Appendix 3.2, and Appendix 4.2.
Note: The control unit can operate only ***one*** heating circuit (hot water duct heater, electric duct heater, or heating circuit)!

2.7 Control for 1 heating circuit (e. g. circulating pump for panel heaters or radiators)

The control unit of the MVHR must be specifically equipped for this purpose. A temperature sensor is used to limit e.g. the flow temperature to 50°C (parameterisable). The heating circuit is switched on or off as a function of room temperature, flow temperature and temperature setpoint.
If the room temperature falls below the setpoint, the heating circuit (pump) will start operating, and will stop when the setpoint is exceeded. The room temperature is recorded by a temperature sensor in the programmer or by an external room temperature sensor.
The setpoint is selected and the heating circuit activated via the control unit (see User Guidance of Automatic Control Unit). A lower night-time temperature can be programmed. The connection shall be made according to Appendix 4.2 as described for the hot water heating register.
Note: Only **one** heating circuit (electric duct heater, hot water duct heater or heating circuit) can be controlled by the control unit!

2.8 External boost switch

One or several boost switches can be connected with the control panel. After pressing the boost switch the fan runs with maximum power for 15 minutes. The connection has to be made according to Appendix 4.1.

2.9 External room temperature sensor

When using a duct heater or heating circuit, the control panel may have to be installed in a place other than the reference place. It is then possible to install an external room temperature sensor to be connected to the control panel according to Appendix 4.1. In that case, the internal sensor of the control panel has to be removed.

2.10 Additional control panel

The MVHR unit can be operated by several (maximum 5) control panels connected in series (e.g. one next to the MVHR, one in the living room). If a duct heater is used, the room temperature is measured
by the first control panel, i.e. the control panel closest to the control unit. The connection has to be made according to Appendix 4.1.

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3. Installation

3.1 Installation of the mechanical ventilation heat recovery (MVHR) unit – air duct connections

The unit has to be installed in a frost-protected room!
Fix the MVHR on the angle brackets with 2% continuous slope to the condensate drain. The dowel pins, in which the tree rods are put, have to withstand a tractive force of min. 0,5 kN. If you intend to install the unit into a false ceiling, you have to make a revision opening (min. 1730 x 760 mm) for filter change and disassembly of the heat exchanger (for cleaning). We recommend using a special drywall revision opening, available at PAUL Wärmerückgewinnung. The cover of the unit can be removed laterally from the 3 hinges. First, you have to remove the self-locking bolt from the central hinge. (further information: see appendix B "Assembly notices WRG climos").

Air ducts have to be insulated (min. 50 mm) in the following areas:
- cold air ducts in warm rooms (airtight tape insulation!)
- warm air ducts in cold rooms

if existing:
- Defroster heater
- air duct heater for backup heating

3.2 Power supply / electric control

The climos 150 DC MVHR unit is connected via a 3 m long control cable with the control unit. A power cord connects the control unit with a 230 VAC 50 Hz socket outlet that has to provided by the user at the place of installation of the control unit.

Important:
- **Never lay control cables to programmers and sensors next to 230/400 VAC cables (minimum distance of 20 cm) and never lay out cables in loops.**
- **Install the control unit in a way to ensure there is no heat build-up and sufficient space for service access. Never enclose the control unit (e. g. no flush mounting).**
- **The internal temperature sensor of the control panel must record/measure the temperature of the room air.**

3.3 Connection and maintenance of the condensate drain hose

Lay the condensate drain hose with continuous slope (min 5%). Do not reduce its diameter. Make sure the condensate can drip off freely at the end with the hose so that it is entirely empty. If there is risk of frost, the hose must be heated (tracer can be delivered). Any rising or horizontal duct connected to the exhaust air outlet shall be provided with a condensate trap at its low point. Further explanations:
Appendix "Assembly notices MVHR climos"

Schematic sketch for condensate discharge line with MVHR climos

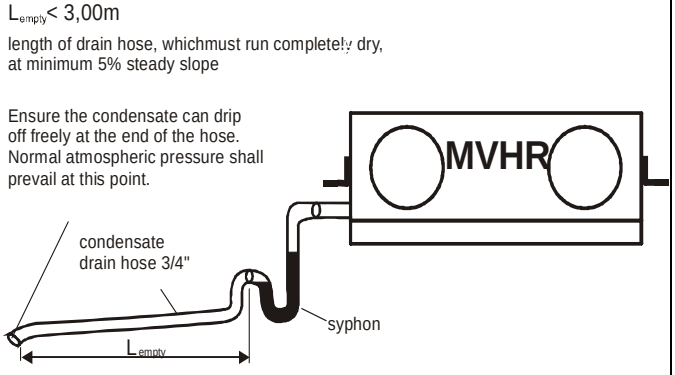
L_{empty}< 3,00m
length of drain hose, whichmust run completely dry, at minimum 5% steady slope
Ensure the condensate can drip off freely at the end of the hose. Normal atmospheric pressure shall prevail at this point.
MVHR
condensate drain hose 3/4"
syphon
L_{empty}

Figure 1

Caution: syphons can dry out!
Alway refill water when:
- starting up the unit
- hearing slurping noises from syphon
- noticing smells from the sewage system
- air is streaming through the syphon
- a dry syphon can be recommended and is available (no smell is getting into the air in case of drying out)

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If a low point can not be avoided in the exhaust duct between the exhaust air outlet of the unit and the wall penetration, connect another condensate discharge there, because at low outdoor temperatures the exhaust air is saturated with water vapor and causes drops to form at the inner walls of the duct. If a silencer is installed at the exhaust outlet of the MVHR unit, it must form a top bend (∩) to be protected from condensate backflows from the exhaust air duct. The MVHR unit should be installed in a way to ensure sufficient slope for proper condensate discharge over a longer distance.

4. Startup

According to DIN 1946-6 unit has to run continuously, except for times of maintenance or repair. Use lowest ventilation step or intermittent holiday program in times of absence.

4.1 Operational availability

- Connect unit power supply
- Fill syphon with water
- Select normal ventilation step

4.2 Air flow adjustment

Air flow settings are made via fan power adjustments with the bypass shut-off insert in place. (factory setting: see Technical Data -Characteristics-) Select the appropriate characteristic curve for normal ventilation (70%) according to the ductwork design (equal pressure loss for all duct runs, e. g. 100 Pa) and the required total air flow, and adjust the fan power at the programmer. Supply and extract air flows can be set to different values, e.g.: if a ground to air heat exchanger is used, it may be necessary to increase the power of the supply air fan via the correction value. (for guidance: see User Guidance for Automatic Control Unit).

4.3 Valve adjustment (ingoing and outgoing air)

- Set fans on **normal ventilation** via control panel
- Adjustment and measurement of air flows at the air valves using a capture hood and an anemometer (see air flow report)
- Set the ventilation slot at the valve, make sure it is not too narrow – risk of flow noise! Better: Reduce the fan power or throttle the air flow early in the duct (install a throttle valve or a foam flow restrictor)
- Balance the air flows at the MVHR unit (if required): Equal supply and extract flows (vary the fan power to balance the flows), the extract flow may be slightly higher than the supply flow
- Readjustment of the valves
- Fill in the values in the “air flow report“ attached

5. Maintenance by owner (user) **(see check list A)**

5.1 General

User maintenance is limited to the periodical change of filters and cleaning of the supply and extract valves. The MVHR unit must not be run without filters. Switch off the unit for filter change and maintenance! Pollen filters should be changed by the user immediately after the pollen dispersal period (depending on the pollen the user is allergic to). **Check the filter after an operating time of 90 day.** According to EN DIN 1946-10, the filters have to be replaced every 3 to 6 months. Filter are obtainable from PAUL Wärmerückgewinnung GmbH or www.paul-lueftung-shop.de.
The filter mats of the extract valves (e.g. bathroom, kitchen, toilet) shall be replaced or cleaned (warm soapy water) every 2 to 3 months or at the owner’s discretion after filter check.

5.2 Filter change

Replace the supply and extract air filters in the MVHR unit when the message **[CHANGE FILTER]** appears on the display of the control panel. The preset filter interval is 90 days. Other filter intervals can be programmed by the user (see User Guidance of Automatic Control Unit, Section 1.2.3).
Change the filters by opening the cover of the MVHR unit (3 spring locks) and removing the filters. Insert the filters according to the flow direction **(marked with an arrow ⇑)**. Put the cover back on the MVHR unit and

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lock it using the three spring locks.

6. Maintenance by skilled personnel (see check list A)

According to DIN1946/6 Chapt. 6, maintenance interval is 2 years and includes the following operations: Filter check or change (see above) and cleaning of the heat exchanger (HX). Cleaning is performed cording to the level of contamination and maintenance interval every 2 years (important for 5-year warranty for the heat exchanger).

Instruction:

1. Disconnect MVHR unit from power supply
2. Remove cover from MVHR unit (3 spring locks)
3. Remove condensate hose from condensate pan and pull out till internal surface of housing insulation
4. Remove six rubber seal profiles from the unit, then loosen the two mounting screws - **Important:** hold heat exchanger – may fall down
5. Pull heat exchanger box out of the housing
6. Clean the heat exchanger with warm soapy water (<50°C) through the two air openings. Use vinegar solution in case of calcification. Turn the heat exchanger and repeat the process, then let the HX drain.
7. In case of calcification, spray vinegar solution from the air inlet side onto the heat exchanger surfaces in 3 applications 20 minutes apart. Rinse water in the end.
8. Check condensate drain and clean, if necessary
9. Reassemble MVHR unit in reverse order; Be careful when inserting the heat exchanger box (housing insulation could be damaged in the area around the condensate pan)
10. Connect condensate hose to condensate pan
11. Fill syphon with water
12. Close the cover (3 spring locks)
13. Reconnect MVHR unit with the power supply

General inspection:

1. Contamination
2. Electrical safety
3. Check leak tightness of condensate connection

The supply and extract air passages (valves) should be cleaned in this context.

7. Control unit

7.1 Ease of use

- 8 independent time programs can be defined and assigned to any day of the week
- Manual adjustment of ventilation steps (off, minimum, normal, maximum)
- Control panel in housing space possible
- Ventilation steps programmable in 1% increments (30-100% of maximum fan power)
- Adjustable balance between supply and extract air fans
- Filter monitor for change interval
- Freeze protection for downstream hot water duct heater
- Standby mode, power input < 2 W

Options (available at extra costs)

- Control of an electric regulating flap at the GHX (either air intake through the ground to air heat exchanger or direct air intake) or
  a brine-defroster (brine/air-HX for ext. air conditioning)
- Control of a frost protection pre-heater (frost protection heater prevents ice formation and replaces a ground to air heat exchanger in winter)
- Constant flow control (permanent monitoring and balancing of the supply and extract air flows, fireplace compliant)
- Control of a heating circuit (e.g. heating circuit pump or electric back-up duct heater up to 2.1 kW) – also with night economy

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- Several boost switches can be connected to the control panel
- The MVHR unit can be operated by several programmers (e.g. one in the place of installation, another one in the living room). If a duct heater is used, the room temperature is recorded at the first control panel

Note: **The description of the control menus can be found in the "User Guidance Automatic Control Unit climos 150 DC"**

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1. Menu structure and logical links

A graphical display of 128 x 64 pixels is provided for the menu dialogue. There are 2 buttons on the right and 3 buttons in the lower section.
The display accepts both graphical characters and graphic pixels.

Graphical construction:

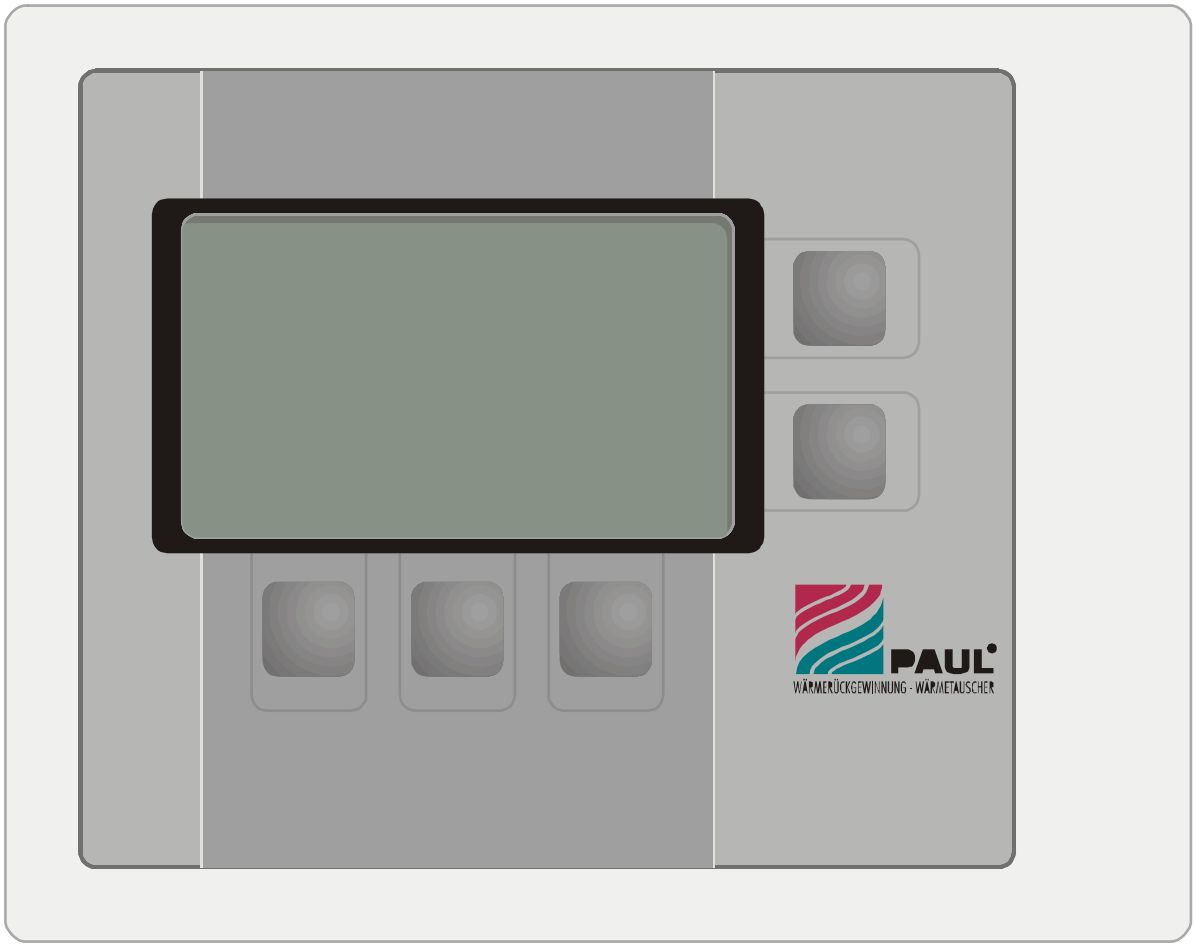
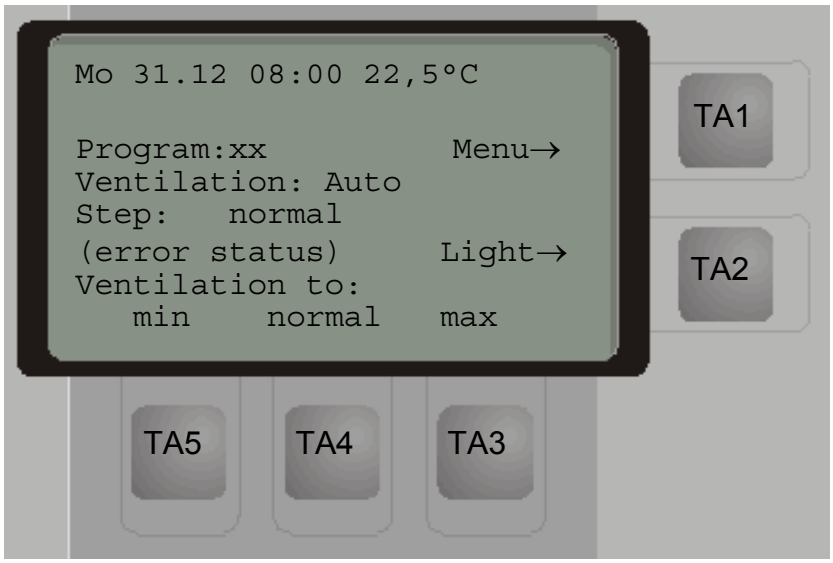


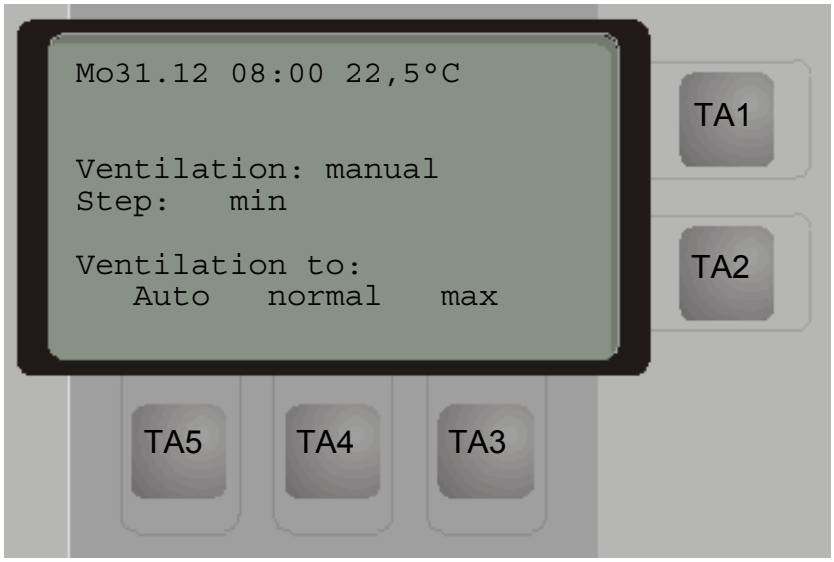
Fig: display in original size (158x125x32)

NOTE: All codes used programming descriptions are explained in Section C "Technical Description of Automatic Control Unit climos 150 DC".

1.1 Basic menu

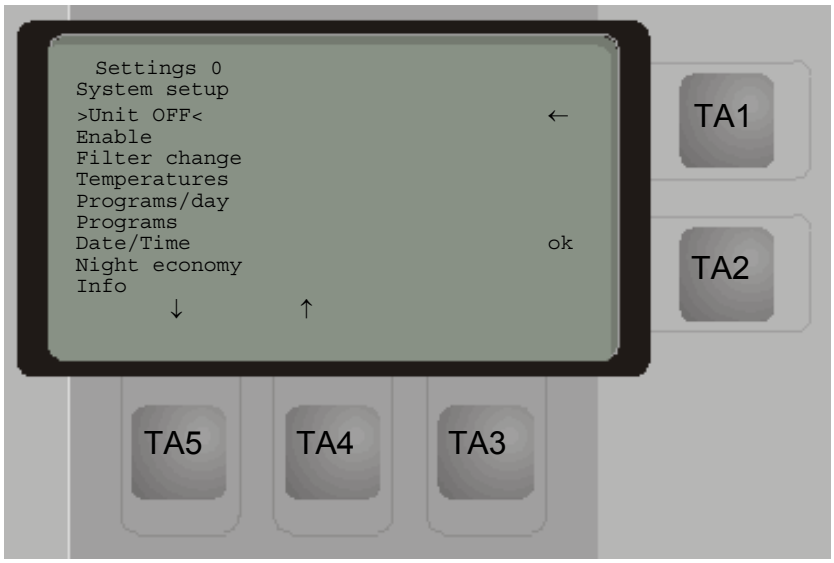


Room temperature is the temperature measured at the first control panel. The item *Ventilation* shows the mode *Manual* or *Auto*.
Step indicates the current power step for the ventilation fan as set by the selected program or chosen manually.
Line 6 provides a clear text message in case of isolated faults or if the filter is to be replaced. In case of simultaneous occurrence of several faults, an error code is indicated (refer to error code table). Pressing the button *TA2* illuminates the display screen for 1 minute.
Operating a boost switch connected to the control panel causes the ventilation to run at maximum power for 15 minutes.



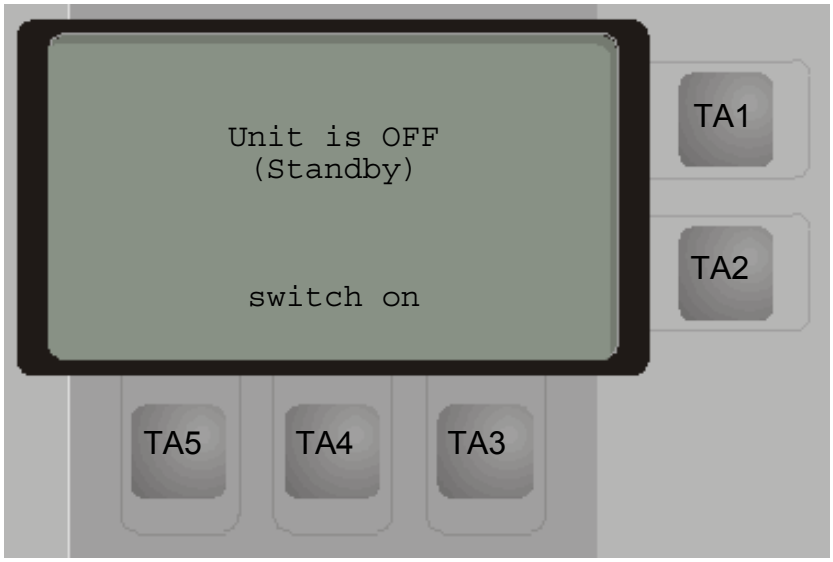
Basic menu: *TA5* button
Pressing the button *TA5* triggers manual minimum ventilation. Normal and maximum ventilation or the automatic mode are adjusted in the same way. In the “manual” mode, no matter what timing program is active, the ventilation step remains unchanged until you select another step or return to the automatic mode. To change over to another step or back to the automatic mode, press the buttons *TA3*, *TA4*, and *TA5*. The menu is accessible only in the automatic mode via *TA1*.

1.2 Menu - Settings 0



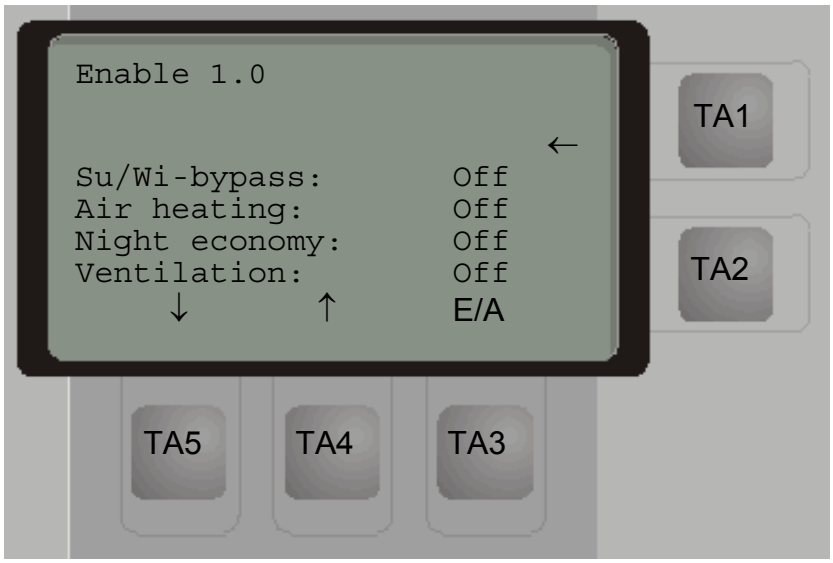
Scroll through the menu items with TA4 and TA5 (up/down arrows), press TA2 to select an item.
Press TA1 to return to the basic menu.
The pre-selected function is “Unit OFF”.

1.2.1 Menu - Settings 0 – System "Off”



The control system is switched off, none of the sensors, modules and fans is monitored or controlled. Reduced power input if the “standby” option is available. Press the TA4 button to switch on the control system, which will start to run the auto program.

1.2.2 Menu - Settings - Enable 1.0



In this menu, the user can activate or deactivate the existing modules in the given system.

Su/wi-Bypass: Control of a bypass flap to bypass the heat exchanger
Prerequisite: system is equipped with a motorized bypass
Heating is set to OFF

Heating: Control of a heating circuit, normally a duct heater.
Prerequisite : Control system is equipped for heater control.
Heater variants:- Hot water duct heater (pump control)
- Electric duct heater (ohmic heating element control)
- ISO- duct heater (PTC heating element control)
- Static heating elements (pump control)

Night economy: Reduction of room temperature setpoint by a given difference at a given time.
Prerequisite: Control system is equipped for heater control..

Ventilation: Fan control

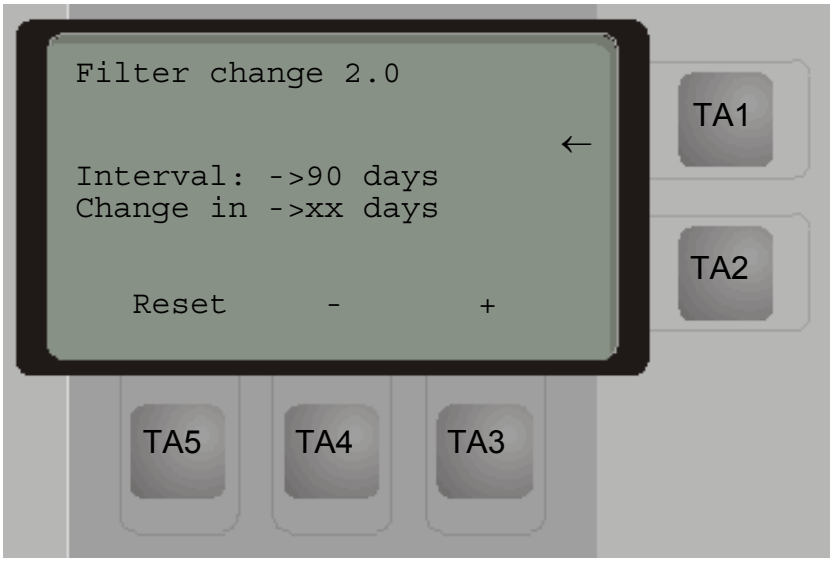
Press TA4 and TA5 (arrow up/down) to scroll through the menu items,
Press TA3 to select ON or OFF
Press TA1 to return to previous menu.
The corresponding modules or devices are activated or deactivated via the software.
If this function is switched off, the related sensor readings are no longer evaluated.

Press TA1 to return to Menu Settings 1.

The active system functions are only displayed in menu Enable, not in the basic menu.

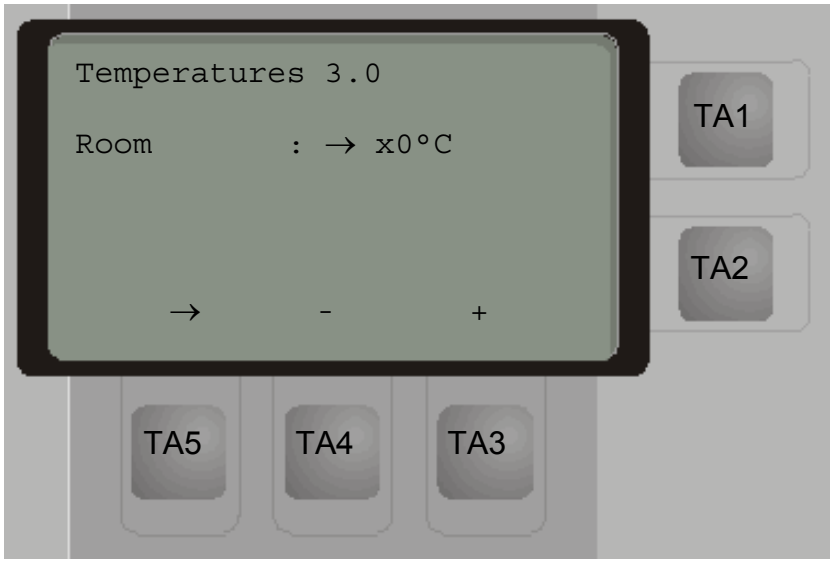
Locks: If heater is ON, the su/wi bypass remains closed.

1.2.3 Menu - Settings - Filter change 2.0



Menu for customising the filter change interval.
The filter change interval can be varied between 30 … 250 days. Press TA3 and TA4 (+,-) to increase or reduce the number of days for the interval.
After pressing Reset, the day counter is reset and a countdown for the remaining time is started.
At the end of the interval the message „Change filter“ is shown in the basic menu in line 6.

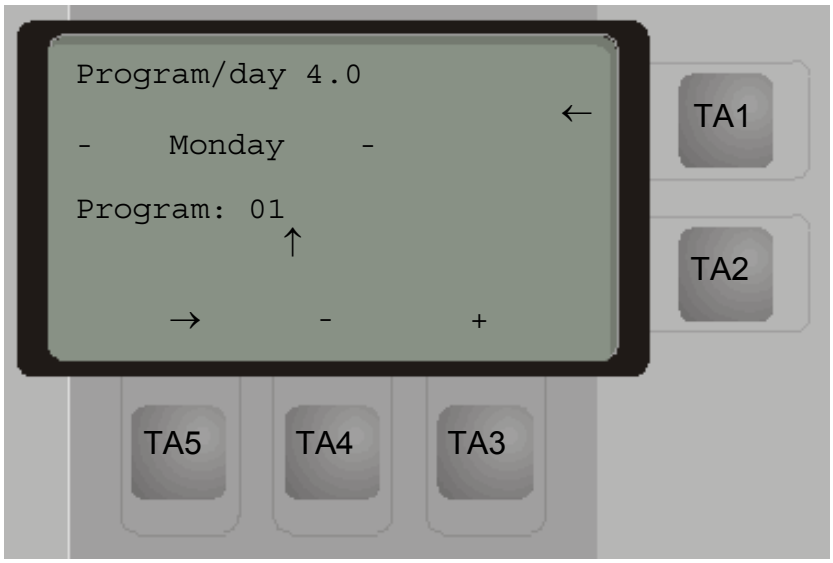
1.2.4 Menu - Settings - Temperatures 3.0



In this menu the user can specify a setpoint for the room temperature (valid for heating mode , heater is controlled via control system).
The hysteresis for the switching processes can be changed in the system setup, but this should be left to a specialist.

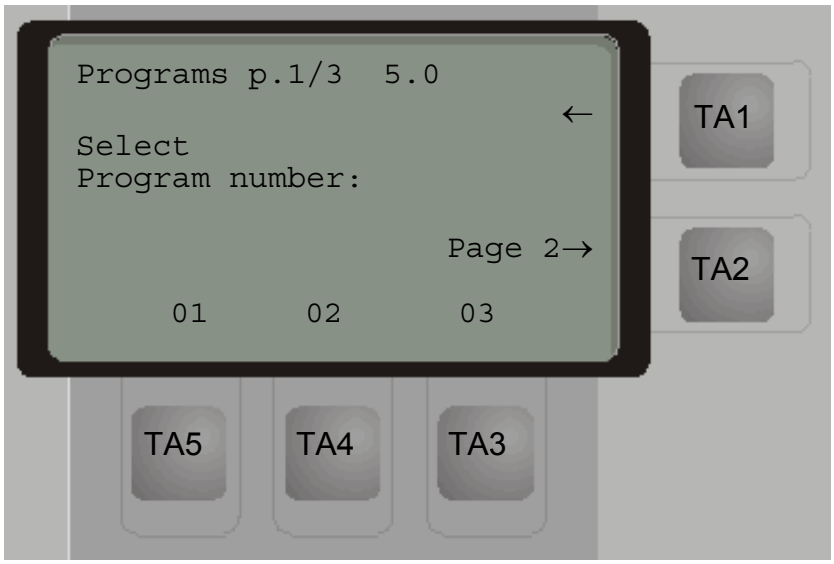
Example:
Room : 20°C

1.2.5 Menu - Settings – Programs/day 4.0



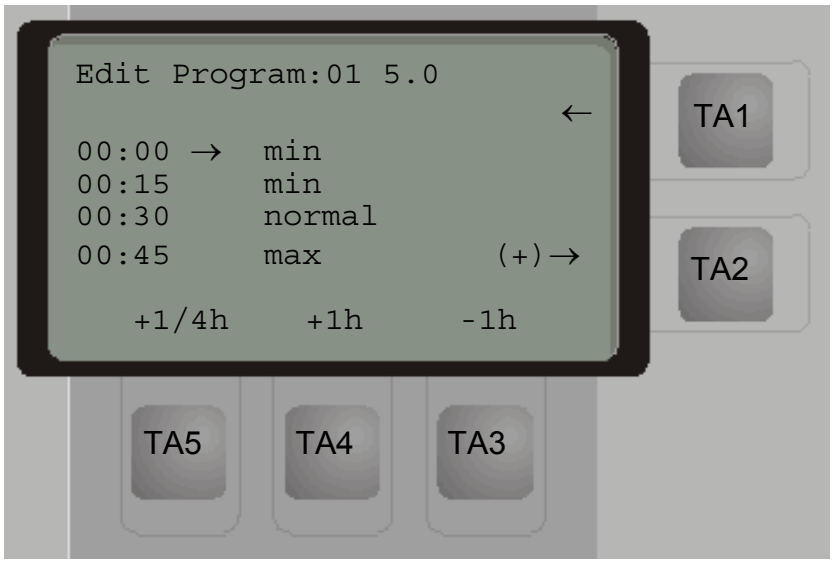
In this menu, the user can assign different programs to the days of the week. So it is possible to run Program 1 on working days and Program 2 on the weekend. The programs can be edited by the user in menu Programs 5.
Press TA5 to scroll through the days of the week and TA3 / TA4 to assign the desired program number.
Press TA1 to return to menu Settings 4.

1.2.6 Menu - Settings - Programs 5.0



In this menu, you can select and edit the eight available programs to your needs.
Press TA2 to scroll through the menu pages 1-3 for the programs 1-8.
Press TA3 to TA5 to open the program to be changed and select the ventilation steps (zero, minimum, normal, or maximum) in 15-min increments.

1.2.6.1 Menu - Settings - Edit Programs 5.0



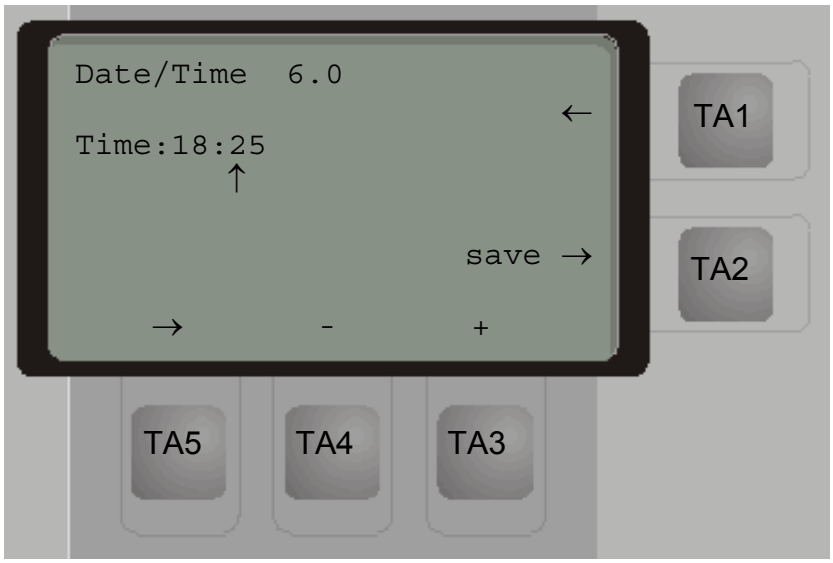
A program can be used to store a specific ventilation step for any quarter of any hour during a day. The fan steps are:

zero	→	Ventilation off
min	→	Minimum ventilation
normal	→	Normal ventilation
max	→	Maximum ventilation

A system is generally designed and dimensioned for normal ventilation. So the minimum or zero steps mean that there is less air exchange than assumed in the system design. On the one hand, there are certain hygienic aspects – on the other, a reduced flow rate in association with a duct heater reduces heat output.
Therefore, the system should be run in normal ventilation mode most of the day.

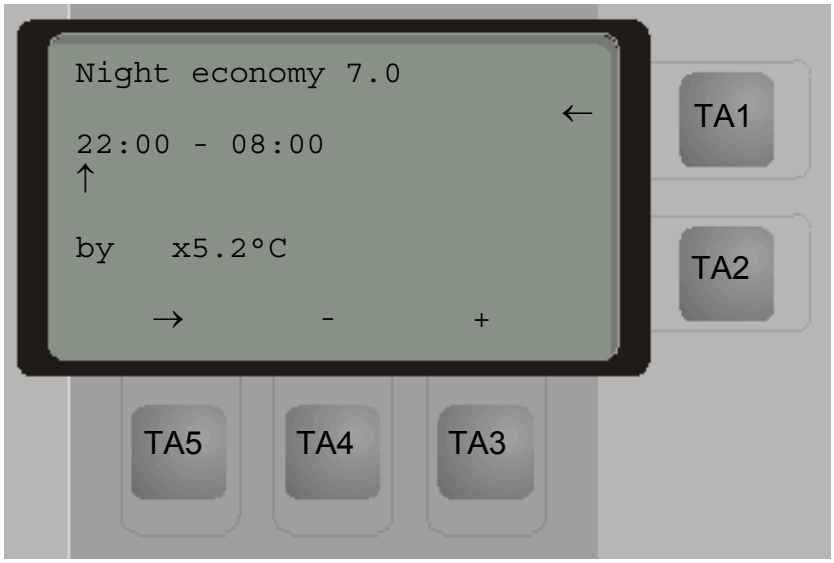
Press TA3 to TA5 to select the desired time.
TA5 advances the cursor by 15 minutes, TA4 by one hour. TA3 sets the cursor back by one hour.
Press TA2 to assign the active time period to a ventilation step. You can choose between the steps zero, min, normal and max.

1.2.7 Menu - Settings - Date/time 6.0



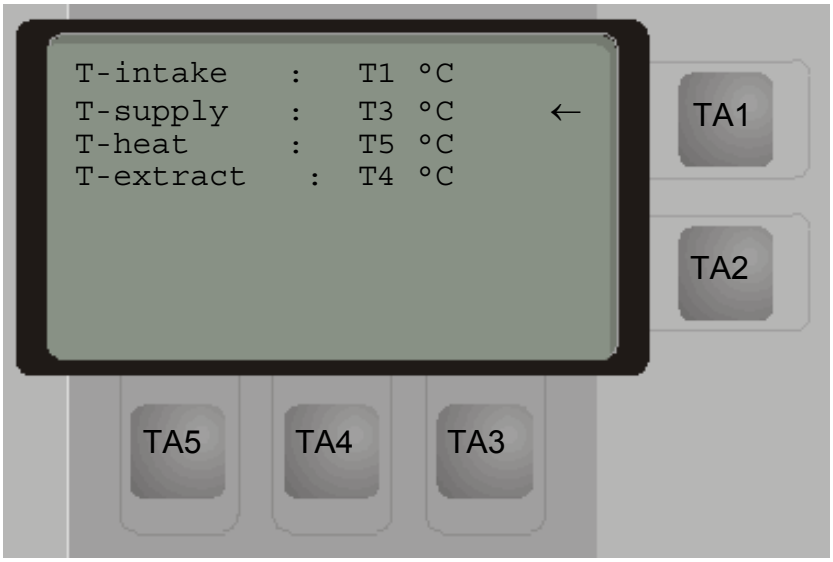
It is important to set the exact time in this menu, otherwise the programs will not run properly.
Press TA5 to scroll through time and date until all values are set. Press “save“ to store.
Save will only appear when all settings have been made.
Press TA1 to leave the menu.

1.2.8 Menu - Settings - Night economy 7.0



Night economy configuration does only make sense if your unit includes a heating controlled via control system.
Times and temperatures can be chosen individually.
Press TA5 to select the numbers, press TA3 and TA4 to change them. Leave menu pressing TA1.

1.2.9 Menu - Settings - Info 8.0



The current temperatures fur the user are shown here.
Press TA1 to return to menu Settings

T-intake	:	Intake air temperature at the inlet of the unit
T-supply	:	Supply air temperature at the outlet of the unit
T-heat	:	Supply air temperature at the outlet of the duct heater
T-extract	:	Extract air temperature at the inlet of the unit

The unit and all extra components are switched off when the user is opening any of the menus. The temperatures shown here are representative only for the very moment the menu is opened in a stable working condition of the unit; long waiting times will show temperatures different from the actual condition.

2. Menu System Setup

The system setup menu is used to make settings that are necessary for the configuration of the system during the startup. **These settings are made by an authorised installer or by the service staff of Paul Wärmerückgewinnung GmbH!** Improper changes of the parameters listed here may cause undesirable effects, the system may possibly work incorrect. Any customer service proven to be caused by improper operator actions will be charged. The system setup is always programmed for the highest configuration whether or not your specific system can use and evaluate all options mentioned here.

```
                        ------------------------
                        |System setup 9.0       |
                        |                       |
                    9   | Enable             <- | TA1
                    0   |>Defroster   <         |
                    1   | Bypass Su/wi          |
                    2   | Brine/GHX          ok | TA2
                    3   | Heat pump             |
                    4   | Solar                 |
                    5   | Duct heater           |
                    6   | Buffer-max            |
                    7   | Ventilation steps     |
                    8   | W-Settings            |
                        |  ↓        ↑           |
                        ------------------------
                          TA5       TA4       TA3
```

Press TA4 and TA5 to scroll through menu 9.0 – 9.9, select item by pressing TA2. Press TA1 to return to previous menu.
The menu items Heat pump, Solar and Buffer-max are only available for compakt 350DC series. The remaining menu items need the corresponding hardware installed.

2.1 Menu System Setup - Defroster

```
                        ------------------------
                        |Defroster 9.0.0        |
                        |                    <- | TA1
                        |PTC: yes/no            |
                        |on: T7< -> (x1)°C      |
                        |Hysteresis:  (H1)°C    |
                        |                       | TA2
                        |                       |
                        | ->       -        +   |
                        ------------------------
                         TA5       TA4       TA3
```

Press TA5 to select value and TA3 / TA4 to adjust value.
Example:

Setting:
```
on: T7 <    2°C
Hysteresis: 1°C
```

Defroster ON: T7 < 1,0 °C

Secondary conditions Defroster ON:
- Defroster enabled
- Temperature limiter ok*
- Flow sensor Fz1 ok*
- Power input Fz1 ok*
- Temperature sensor T7 plausible
- Ventilation enabled
- Ventilation step not equal to zero

Defroster OFF: T7 > 3,0 °C

Secondary conditions Defroster OFF:

Defroster not enabled
Temperature limiter faulty*
Flow sensor Fz1 faulty*
Power input Fz1 faulty*
Temperature sensor T7 not plausible
Ventilation not enabled

*) applies to frost protection heater with ohmic heating element

2.2 Menu System Setup - Bypass summer/winter (not active)

```
          ------------------------
          |Bypass Su/wi 9.1.0    |
          |                  <-  | TA1
      0   |>Temperatures<        |
      1   | Servomotor           |
          |                      |
          |                  ok  | TA2
          |                      |
          | ->                   |
          ------------------------
           TA5       TA4       TA3
```

Press TA5 to select menu item and TA2 to confirm

2.2.1 Menu System Setup - Temperatures - Bypass summer/winter (not active)

```
          ------------------------
          |Bypass Su/wi 9.1.0.0  |
          |                  <-  | TA1
          |Bypass open if:       |
          |T1<T4 & T4>:-x4.1°C   |
          |T1>T4 & T4<: x4.2°C   |
          |Hysteresis:   H4°C ok | TA2
          |                      |
          | ->       -       +   |
          ------------------------
            TA5      TA4       TA3
```

Press TA5 to select value and TA3 / TA4 to adjust the value.
Example:

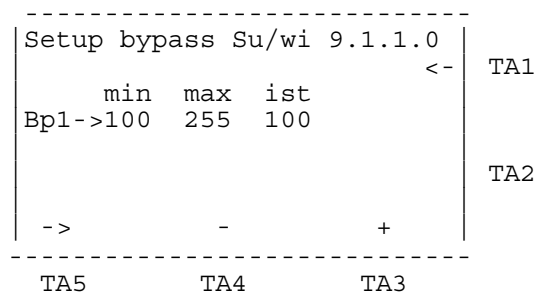
x4.1= 23,0 °C
x4.2= 19,0 °C
H4= 1,0 K
(Please note: x4.1 > x4.2)

Bypass OPEN:	TInt<TExt & TExt> 24,0°C	*Secondary conditions bypass OPEN:*
Bypass CLOSED:	TInt<TExt & TExt< 22,0°C	Heating OFF T1 and T4 plausible Bypass enabled
Bypass OPEN:	TInt>TExt & TExt< 18,0°C	*Secondary conditions bypass CLOSED:*
Bypass CLOSED:	TInt>TExt & TExt> 20,0°C	Heating enabled T1 and T4 not plausible Bypass not enabled

TInt- Intake air temperature at the inlet of the unit
TExt- Extract air temperature at the inlet of the unit

Heating and bypass can not be used at the same time, heating has priority. When heating is enabled, the bypass is closed (winter operation). If there is no integrated heating, the bypass has to be disabled in winter time (Menu Settings Enable 1.0).

2.2.2 Menu System Setup - Servomotor - Bypass summer/winter (<u>not active</u>)

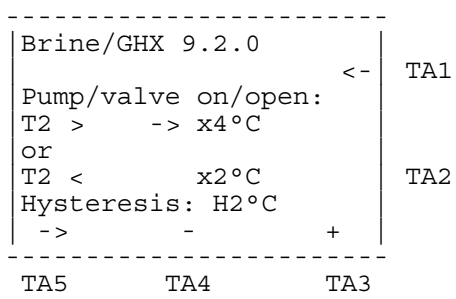


Caution: Values are just examples!

Press TA5 to select menu item, press TA3 / TA4 to adjust value.

min → Open
max → Closed

2.3 Menu System Setup - Brine-defroster pump/GHX regulating flap



Press TA5 to select menu item, press TA3 / TA4 to adjust value.

Example:

x4= 24,0 °C
x2= 5,0 °C for GHX regulating flap
or x2= 0,0 °C for brine-defroster
H2= 1,0 °C

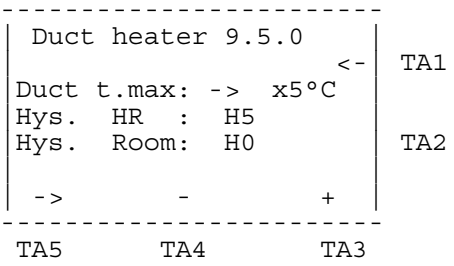
Secondary conditions:
T2 plausible
Brine-defroster pump/regulating flap GHX enabled

Brine-defroster pump/regulating flap GHX ON/OPEN: TInt < -1,0/4,0 °C or TInt > 25,0 °C
Brine-defroster pump/regulating flap GHX OFF/CLOSED: 1,0/6,0 °C < TInt < 23,0 °C

TInt → Intake air temperature (from outdoor sensor)

NOTE: GHX regulating flap OPEN means air intake via the ground to air heat exchanger

2.4 Menu System Setup - Duct heater



Press TA5 to select menu item, press TA3 / TA4 to adjust value.

x5 absolute maximum for duct temperature, causing the duct heater (DCTH) to stop operating.
!!! Limited duct temperature !!! SAFETY REQUIREMENTS !!!

When DCTH is enabled, summer/winter bypass is automatically closed.

Hysteresis Room (H0) defines the ON and OFF switching points related to T0 (room sensor in control panel).

DCTH ON: Room temperature below setpoint and maximum duct temperature not reached
DCTH OFF: Room temperature exceeds setpoint or maximum duct temperature reached

Example:

x0= 21,0°C	Duct heater ON:	T5 < 20,5°C
H0= 0,5 K	Duct heater OFF:	T5 > 21,5°C
X5= 50,0°C	Duct heater ON:	T5 < 49,0°C
H5= 1,0 K	Duct heater OFF:	T5 > 51,0°C

Secondary conditions DCTH ON:
Temperature limiter ok (only for electric duct heater with ohmic heating element)
Flow sensor Fz4 ok (only for electric duct heater with ohmic heating element)
Power input Fz4 ok (only for electric duct heater with ohmic heating element)
T0 / T5 plausible
Heating enabled
Ventilation step not equal to zero

Secondary conditions DCTH OFF:
Temperature limiter fault (only for electric duct heater with ohmic heating element)
Flow sensor Fz4 fault (only for electric duct heater with ohmic heating element)
Power input Fz4 fault (only for electric duct heater with ohmic heating element)
T0 / T5 not plausible
Air heating disabled

2.5 Menu System Setup - Ventilation steps

```
-----------------------
|Fan 9.7.0            |
|->+constand flow   <-| TA1
|  +SUP   +EXT        |
|  030    030 min     |
|  050    050 normal  |
|  085    085 max  ST->| TA2
|  100:   100 correct.|
|  ->      (-1)   (+1)|
-----------------------
  TA5       TA4     TA3
```

+/- are used to define:

+ constant flow (constant flow control ON)
- constant flow (constant flow control OFF)

For +Constant flow (constant flow control ON), the system has to be equipped with analogue flow sensors for supply air Fz2 and exhaust air Fz3.
The flow sensors were calibrated by pairs before delivery.
If constant flow control is not desired, the air flow is regulated via PWM control of the fans.
For -Constant flow (constant flow control OFF), no flow sensors Fz2 and Fz3 are needed.

+/- SUP/EXT

for (+) positive fan control (e.g. ebm-fans in campus, thermos, atmos series)
für (-) negative fan control (e.g. Papst-fans in multi, climos series)

are used for response adjustment of the fans.

Fan power for each ventilation step is adjusted by means of the buttons TA3 to TA5.
The fan power ratio is adjusted with the coefficient of correction, e.g.

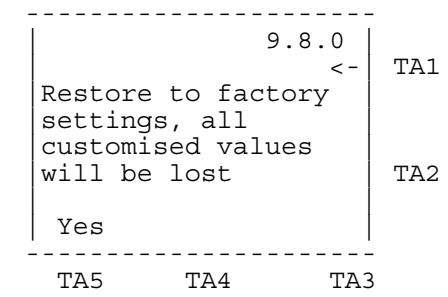
100 : 100	Equal power for supply and extract air
100 : 120	Supply air lower than extract air
100 : 080	Supply air higher than extract air

Choose step width via TA2 (incr. of 1 or 10).

The fan power for supply and extract air must not be set to values higher than 100, because the fan can not yield more than 100% and control may not work properly. For a correction value >100, it may be required to lower the “max” ventilation step until the values for both fans are ≤100.
The minimum ventilation step may not be lower than 030.

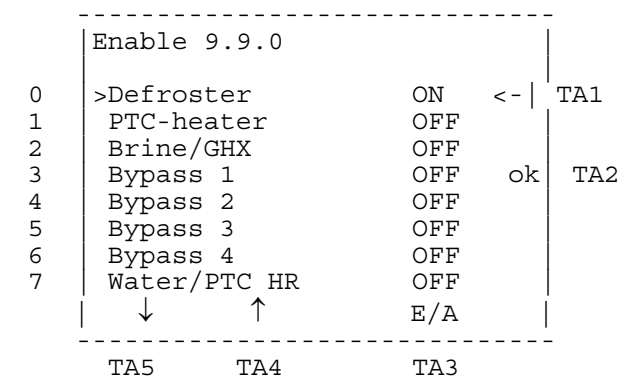
While the entries are made for min, normal, max values, the ventilations fans run at the currently adjusted speed so the calibration can be continued.
Calibration is done at “normal" ventilation.

2.6 Menu System Setup - Factory settings



In this menu the factory settings, programmed via PC, can be restored.
The control system automatically restarts after pressing TA5.

2.7 Menu System Setup - Enable 9.9.0



press TA4 and TA5 (arrow up/down) to scroll through the menu items 9.9.0 – 9.9.7 and press TA3 to choose On or OFF.
The corresponding modules or devices are activated or deactivated via the software.
If this function is turned off, the related sensor readings are suppressed.
Press TA1 to return to menu System setup Enable 9.9.
The active functions are only shown in menu Enable, not in the basic menu.
Bypass 2, 3, 4 are functions only available in compakt 350 DC unit.

3.0 Menu Service

3.1 Service menu 0 Temperatures

```
-----------------------
|Service menu 0       |
|T0:22,0°  T1:--x--   | TA1
|T2:--x--  T3:--x--   |
|T4:--x--  T5:--x--   |
|T6:--x--  T7:--x--   |
|T8:--x--  T9:--x--   | TA2
|                     |
|  ->                 |
-----------------------
  TA5      TA4      TA3
```

This menu displays the temperatures from the sensors T0 to T9.
If a sensor is not plausible, i.e. sensor is not connected, has a broken wire or is short-circuited, --x—is displayed.

Press TA5 to switch to Service menu 1.

3.2 Service menu 1 Defroster / Brine-defroster/ regulating flap

```
----------------------------
|Service1 Defr / Brine/GHX |
|FHL OFF   T7:--x--        | TA1
|x1:02,0°  H1:01,0°        |
|STB:+ FZ1:+ IFZ1: +       |
|Brine/GHX f OFF           |
|T2:22,0   x2:05,0         | TA2
|H2:01,0                   |
|x4:25,0                   |
----------------------------
  TA5      TA4       TA3
```

This menu shows the parameters for the defroster and for the brine-defroster pump / GHX regulating flap.

Defroster

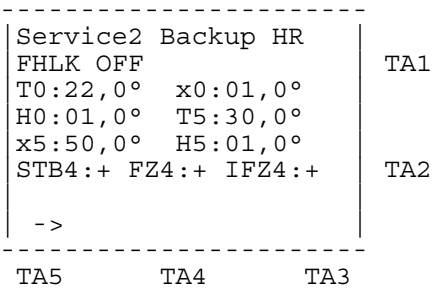
FHL	capital letters mean:	lower case letter mean:
	F Defroster enabled	f Defroster not enabled
	H Hardware detected	h Hardware not detected
	L Ventilation enabled	l Ventilation not enabled

T7 exhaust air temperature
X1 programmed start temperature defroster
H1 Hysteresis for x1 (x1 +/- H1)

Brine-defroster/GHX regulating flap

F brine-defroster/ pump GHX regulating flap enabled Status ON or OFF
T2 Outdoor temperature
X2 Tmin brine-defroster pump ON / GHX regulating flap OPEN
X4 Tmax brine-defroster pump ON / GHX regulating flap OPEN
H2 Hysteresis for x2 and x4

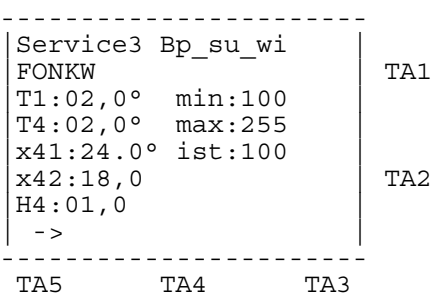
3.3 Service menu 2 Backup duct heater



This menu shows the parameters of the backup duct heater.

FHLK	capital letters mean:	lower case letter mean:
	F duct heater enabled	f duct heater not enabled
	H Hardware detected	h Hardware not detected
	L Ventilation enabled	l Ventilation not enabled
	K Cooling mode selected (heating not possible)	k Cooling mode disabled
T0	Room temperature	
X0	Room temperature setpoint	
H0	Hysteresis for x0 (x0 +/- H0)	
T5	Duct temperature	
X5	max. duct temperature	
H5	Hysteresis for x5 (x5 +/- H5)	

3.4 Service menu 3 Bypass summer/winter



This menu shows the parameters for the summer/winter bypass.

FONKW	capital letters mean:	lower case letter mean:
	F Bypass enabled	f Bypass not enabled
	O Bypass in proper position	o Bypass in wrong position
	N backup duct heater enabled	n backup duct heater disabled
	K Cooling mode enabled	k Cooling mode disabled
	W Heat pump ON	w Heat pump OFF
T1	Intake air temperature at the inlet of the unit	
T4	Extract air temperature	
min:	Regulating flap CLOSED	
max:	Regulating flap OPEN	
ist:	current flap position	
X41	selected temperature for bypass OPEN	
X42	selected temperature for bypass CLOSED	
H4	Hysteresis for x41/x42 (x +/- H4)	

4. Appendix

4.1 Program structure with factory settings

Factory settings of programs 1 - 8

	Progr. Standard 1			Progr. Standard 2			Progr. Weekday			Progr. Weekend			Progr. Holiday 1			Progr. Summer			Progr. Party			Progr. Holiday 2		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
0:00	X			X				X			X		X				X			X				
0:15	X			X				X			X		X				X			X				
0:30	X			X				X			X		X				X			X				
0:45	X			X				X			X		X				X			X				
1:00	X			X				X			X		X				X			X				
1:15	X			X				X			X		X				X			X				
1:30	X			X				X			X		X				X			X				
1:45	X			X				X			X		X				X			X				
2:00	X			X				X			X		X				X			X				
2:15	X			X				X			X		X				X			X				
2:30	X			X				X			X		X				X			X				
2:45	X			X				X			X		X				X			X				
3:00	X			X				X			X		X				X			X				
3:15	X			X				X			X		X				X			X				
3:30	X			X				X			X		X				X			X				
3:45	X			X				X			X		X				X			X				
4:00	X			X				X			X		X				X			X				
4:15	X			X				X			X		X				X			X				
4:30	X			X				X			X		X				X			X				
4:45	X			X				X			X		X				X			X				
5:00	X			X				X			X		X				X			X				
5:15	X			X				X			X		X				X			X				
5:30	X			X				X			X		X				X			X				
5:45	X			X				X			X		X				X			X				
6:00		X		X				X			X		X				X				X			X
6:15		X		X				X			X		X				X				X			X
6:30		X		X				X			X		X				X				X			X
6:45		X		X				X			X		X				X				X			X
7:00			X	X			X				X		X								X			
7:15			X	X			X				X		X								X			
7:30		X		X			X				X		X								X			
7:45		X		X			X				X		X								X			
8:00		X		X			X				X		X								X			
8:15	X			X			X				X		X								X			
8:30	X			X			X				X		X								X			
8:45	X			X			X				X		X								X			
9:00	X			X			X				X		X								X			
9:15	X			X			X				X		X							X				
9:30	X			X			X				X		X							X				
9:45	X			X			X				X		X							X				
10:00	X			X			X				X		X							X				
10:15	X			X			X				X		X							X				
10:30	X			X			X				X		X							X				
10:45	X			X			X				X		X							X				
11:00	X			X			X				X		X							X				
11:15	X			X			X				X		X							X				
11:30	X			X			X				X		X							X				
12:00	X			X			X				X		X							X				

	Progr. 1			Progr. 2			Progr. 3			Progr. 4			Progr. 5			Progr. 6			Progr. 7			Progr. 8		
	Standard 1			Standard 2			Weekday			Weekend			Holiday 1			Summer			Party			Holiday 2		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
12:15			X	X			X					X	X								X			X
12:30			X	X			X					X	X								X			X
12:45			X	X			X					X	X								X			X
13:00			X	X			X					X	X								X			X
13:15	X			X			X				X		X							X				
13:30	X			X			X				X		X							X				
13:45	X			X			X				X		X							X				
14:00	X			X			X				X		X							X				
14:15	X			X			X				X		X							X				
14:30	X			X			X				X		X							X				
14:45	X			X			X				X		X							X				
15:00	X			X			X				X		X							X				
15:15	X			X			X				X		X							X				
15:30	X			X			X				X		X							X				
16:00	X			X			X				X		X							X				
16:15	X			X			X				X		X							X				
16:30	X			X			X				X		X							X				
16:45	X			X			X				X		X							X				
17:00	X			X			X				X		X							X				
17:15	X			X				X			X		X							X				
17:30	X			X				X			X		X							X				
17:45	X			X				X			X		X							X				
18:00	X				X			X			X		X							X				
18:15	X				X			X				X	X							X				
18:30	X				X			X				X	X							X				
18:45	X				X			X				X	X							X				
19:00	X				X			X				X	X								X			
19:15	X				X			X			X		X								X			
19:30	X				X			X			X		X								X			
19:45	X				X			X			X		X								X			
20:00	X				X			X			X		X					X			X			X
20:15			X		X			X			X		X					X			X			X
20:30			X		X			X			X		X					X			X			X
20:45			X		X			X			X		X					X			X			X
21:00			X		X			X			X		X					X			X			X
21:15	X			X				X			X		X				X				X			
21:30	X			X				X			X		X				X				X			
21:45	X			X				X			X		X				X				X			
22:00	X			X				X			X		X				X				X			
22:15	X			X				X			X		X				X				X			
22:30	X			X				X			X		X				X				X			
22:45	X			X				X			X		X				X				X			
23:00	X			X				X			X		X				X				X			
23:15	X			X				X			X		X				X				X			
23:30	X			X				X			X		X				X				X			
23:45	X			X				X			X		X				X				X			
0:00	X			X				X			X		X				X				X			

Step 1 = minimum ventilation
Step 2 = normal ventilation
Step 3 = maximum ventilation

4.2 Menu structure

Settings 0 ... 9

				Basic menu					
Settings	0	Settings	1	Settings	2	Settings	3	Settings	4
Unit in standby		Enable ON/OFF		Filter change		Temperature setpoints		Programs/ day	
Unit OFF		Air heating	1.0	Filter interval	2.0	Temperatures	3.0	Programs/ day	4.0
		Night economy	1.1			Room		Assignment of	
		Ventilation	1.5					programs	
		Summer bypass	1.6					to the weekdays	
Settings	5	Settings	6	Settings	7	Settings	8	Settings	9
Programs 1-8		Date / Time		Night economy		Info		System setup	
Assignment of ventilation steps to the programs 1-8		Time and date setting		Set night hours and reduction temperature		T-intake T-supply T-heat T-extract		Settings by skilled personnel only	

System setup 9.0 ... 9.9

				System setup					
System setup	9.0	System setup	9.1	System setup	9.2	System setup	9.3	System setup	9.4
De-froster	9.0.0	Bypass Su/wi	9.1.0	regulating flap / pump brine-defroster	9.2.0	Heat pump	9.3.0	Solar	9.4.0
Unit OFF		Tempe-ratures	9.1.0.0	Set temp. window for flap valve		HP-bypasses	9.3.0.0	OFF-temperatures	
		Servo motor	9.1.1.0			Position OFF	9.3.1.0	Define solar pump	
						Position Heat	9.3.2.0		
						Position Cool	9.3.3.0		
						Temperatures	9.3.4.0		

System setup	9.5	System setup	9.6	System setup	9.7	System setup	9.8	System setup	9.9
Duct heater	9.5.0	Buffer-max	9.6.0	Ventilation steps	9.7.0	Factory settings	9.8.0	Enable	9.9
Set max. duct temperature and room/duct temp. hysteresis		set max. buffer temperature		Fan type selection constant flow control fan power assignment balancing		Loading default values programmed in the factory		Defroster PTC defr. Brine defr. / GHX regulating flap Bypass 1 Bypass 2 Bypass 3 Bypass 4 Water/PTC duct heater	9.9.0 9.9.1 9.9.2 9.9.3 9.9.4 9.9.5 9.9.6 9.9.7

4.3 Fault messages

Faults are numbered according to their significance from the left to the right; the first number has significance 1.

In case of a fault an error message describing the fault is displayed in the control panel.
The faults are indicated by an error code if there are more than one faults.
The error code consists of a 10-digit code, one digit is in the range of 0...F (0...9,A,B,C,D,E,F). One digit represents up to 4 possible faults. In case of multiple faults, the error code is displayed in the basic menu; in case of only one fault an error message is displayed in the basic menu.

Fault: 1 2 3 4 5 6 7 8 9 10

Faults are numbered according to their significance from the left to the right; the first number has significance 1.

0XXXXXXXXX:	no faults in this group
1XXXXXXXXX:	FAULT IN ROOM TEMPERATURE SENSOR T0
2XXXXXXXXX:	FAULT IN INTAKE AIR TEMPERATURE SENSOR T1
3XXXXXXXXX:	FAULT IN ROOM TEMPERATURE SENSOR T0 FAULT IN INTAKE AIR TEMPERATURE SENSOR T1
4XXXXXXXXX:	FAULT IN OUTDOOR TEMPERATURE SENSOR T2
5XXXXXXXXX:	FAULT IN ROOM TEMPERATURE SENSOR T0 FAULT IN OUTDOOR TEMPERATURE SENSOR T2
6XXXXXXXXX:	FAULT IN INTAKE AIR TEMPERATURE SENSOR T1 FAULT IN OUTDOOR TEMPERATURE SENSOR T2
7XXXXXXXXX:	FAULT IN ROOM TEMPERATURE SENSOR T0 FAULT IN INTAKE AIR TEMPERATURE SENSOR T1 FAULT IN OUTDOOR TEMPERATURE SENSOR T2
8XXXXXXXXX:	FAULT IN SUPPLY AIR TEMPERATURE SENSOR T3
9XXXXXXXXX:	FAULT IN ROOM TEMPERATURE SENSOR T0 FAULT IN SUPPLY AIR TEMPERATURE SENSOR T3
AXXXXXXXXX:	FAULT IN INTAKE AIR TEMPERATURE SENSOR T1 FAULT IN SUPPLY AIR TEMPERATURE SENSOR T3
BXXXXXXXXX:	FAULT IN ROOM TEMPERATURE SENSOR T0 FAULT IN INTAKE AIR TEMPERATURE SENSOR T1 FAULT IN SUPPLY AIR TEMPERATURE SENSOR T3
CXXXXXXXXX:	FAULT IN OUTDOOR TEMPERATURE SENSOR T2 FAULT IN SUPPLY AIR TEMPERATURE SENSOR T3
DXXXXXXXXX:	FAULT IN ROOM TEMPERATURE SENSOR T0 FAULT IN OUTDOOR TEMPERATURE SENSOR T2 FAULT IN SUPPLY AIR TEMPERATURE SENSOR T3
EXXXXXXXXX:	FAULT IN INTAKE AIR TEMPERATURE SENSOR T1 FAULT IN OUTDOOR TEMPERATURE SENSOR T2 FAULT IN SUPPLY AIR TEMPERATURE SENSOR T3

FXXXXXXXXX:	FAULT IN ROOM TEMPERATURE SENSOR T0 FAULT IN INTAKE AIR TEMPERATURE SENSOR T1 FAULT IN OUTDOOR TEMPERATURE SENSOR T2 FAULT IN SUPPLY AIR TEMPERATURE SENSOR T3
X0XXXXXXXX:	no faults in this group
X1XXXXXXXX:	FAULT IN EXTRACT AIR TEMPERATURE SENSOR T4
X2XXXXXXXX:	FAULT IN BACK-UP DUCT HEATER TEMPERATURE SENSOR T5
X3XXXXXXXX:	FAULT IN EXTRACT AIR TEMPERATURE SENSOR T4 FAULT IN BACK-UP DUCT HEATER TEMPERATURE SENSOR T5
XX4XXXXXXX:	FAULT STB1
XX8XXXXXXX:	FAULT STB4
XXCXXXXXXX:	FAULT STB1 FAULT STB4
XXX0XXXXX:	no faults in this group
XXX1XXXXXX:	FAULT FZ1
XXX2XXXXXX:	FAULT FZ4
XXX3XXXXXX:	FAULT FZ1 FAULT FZ4
XXX4XXXXXX:	FAULT IFZ1
XXX5XXXXXX:	FAULT FZ1 FAULT IFZ1
XXX6XXXXXX:	FAULT FZ4 FAULT IFZ1
XXX7XXXXXX:	FAULT FZ1 FAULT FZ4 FAULT IFZ1
XXX8XXXXXX:	FAULT IFZ4
XXX9XXXXXX:	FAULT FZ1 FAULT IFZ4
XXXAXXXXXX:	FAULT FZ4 FAULT IFZ4
XXXBXXXXXX:	FAULT FZ1 FAULT FZ4 FAULT IFZ4
XXXCXXXXXX:	FAULT IFZ1 FAULT IFZ4

XXXDXXXXXX:	FAULT FZ1 FAULT IFZ1 FAULT IFZ4
XXXEXXXXXX	FAULT FZ4 FAULT IFZ1 FAULT IFZ4
XXXFXXXXXX:	FAULT FZ1 FAULT FZ4 FAULT IFZ1 FAULT IFZ4

XXXX0XXXXX:	no faults in this group
XXXX1XXXXX:	FAULT DEFROSTER NOT DETECTED
XXXX2XXXXX:	FAULT BACKUP DUCT HEATER NOT DETECTED
XXXX3XXXXX:	FAULT DEFROSTER NOT DETECTED FAULT BACKUP DUCT HEATER NOT DETECTED

XXXXX0XXXX:	no faults in this group
XXXXX1XXXX:	FAULT SUMMER-WINTER BYPASS MOTOR

XXXXXX0XXX:	no faults in this group
XXXXXX4XXX:	FAULT FILTER WAS NOT CHANGED

Example:
Error code:
00000140 means fault "Summer-Winter bypass motor" and fault "Filter was not changed" occur at the same time.

NOTE:
If an error T3 is indicated to “danger of frost “, scolded the equipment off and can be put only by brief tension disconnection again into operation.

XXXDXXXXXX: FAULT FZ1
FAULT IFZ1
FAULT IFZ4

XXXEXXXXXX FAULT FZ4
FAULT IFZ1
FAULT IFZ4

XXXFXXXXXX: FAULT FZ1
FAULT FZ4
FAULT IFZ1
FAULT IFZ4

XXXX0XXXXX: no faults in this group

XXXX1XXXXX: FAULT DEFROSTER NOT DETECTED

XXXX2XXXXX: FAULT BACKUP DUCT HEATER NOT DETECTED

XXXX3XXXXX: FAULT DEFROSTER NOT DETECTED
FAULT BACKUP DUCT HEATER NOT DETECTED

XXXXX0XXXX: no faults in this group

XXXXX1XXXX: FAULT SUMMER-WINTER BYPASS MOTOR

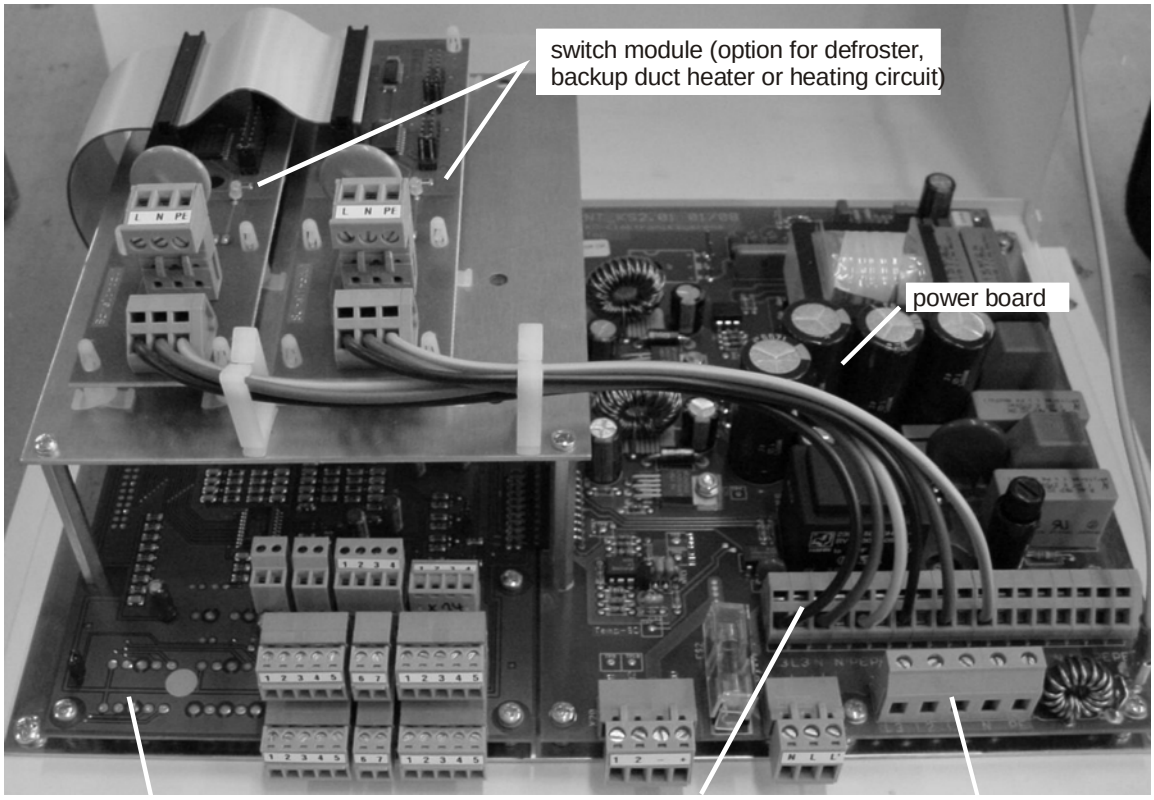
XXXXXX0XXX: no faults in this group

XXXXXX4XXX: FAULT FILTER WAS NOT CHANGED

Example:
Error code:
00000140 means fault "Summer-Winter bypass motor" and fault "Filter was not changed" occur at the same time.

1. Introduction

The ventilation control unit is a modular microcontroller system. The following modules are available for customization: switch mode power supply, controller board, switch module and program panel.
All controlling and regulating tasks of the ventilation control unit are organized by the main controller unit (HCE). All parameters can be programmed via the control panel.
A 5-button control panel with display offers operator access. If needed, several displays can be connected in series.
The fans and control unit are supplied by a switch mode power supply.
The control system can be extended by two switch modules for controlling 230 VAC terminals or loads. Due to the odular construction of the control system, it is possible to set up simple as well as complex control configurations covering all PAUL mechanical ventilation control variants.


switch module (option for defroster, backup duct heater or heating circuit)
power board
main controller unit (HCE)
voltage distribution (230V)
mains feeder

Photograph shows a fully equipped control unit

2. Main Controller Unit (HCE)

The HCE works with a microcontroller PIC 16 C67 with 20 MHz clock rate. Analog input variables are evaluated by one two AD converters with 8 analog channels.
The HCE and all other modules are supplied by a switch mode power supply.
A 20-pos. connector (ST_UB) between the power pack and the controller board supplies 12 VDC and 24 VDC to the HCE.
Up to 8 modules can be connected for 230 VAC ventilation equipment. The modules are operated and supplied with the operating voltages (12/24 VDC) by the HCE via the internal 34-pos. bus connector (ST_BUS).
All sensors and bypass motors are connected to the HCE.

The connected sensors are checked and evaluated according to the enabled functions or modules. Once a module or a function is enabled, a hardware detection and sensor plausibility check is performed before the program is actually run. If an error is found, the control panel display shows the error log and the relevant program part is not executed.
So it is possible to disable or enable any function or module via the control panel.
A distinction is made between user and system settings and validations.

Pin assignments power pack ST_UB

Pins:

1	12 P from power pack
2	GND
3	12 P power pack
4	GND
5	12 P power pack
6	GND
7	NPN open collector output from HCE for GHX regulating flap / brine-defroster pump on power pack
8	GND
9	NPN open collector output power pack power / standby from HCE
10	GND
11	PWM-Out fan2 (extract air)
12	GND
13	PWM-Out fan1 (supply air)
14	GND
15	24P power pack
16	GND
17	24P power pack
18	GND
19	24P power pack
20	Open collector signal from PP to Controller overtemperature step 1

Pin assignments controller ST_BUS

Pins:

1	DB0 (data bit input/output)
2	DB1
3	DB2
4	DB3
5	DB4
6	DB5
7	DB6
8	DB7
9/10	GND
11/12	5P
13/14	GND
15	AD0 (Adressbit output)
16	AD1
17	AD2
18	AD3
19	AD4
20	AD5
21	AD6
22	AD7
23/24	GND
25/26	24 P
27/28	12 P
29/30	GND
31	Bus select0
32	Bus select1
33	Bus select2
34	enable

The bus select signals contact the different module (e.g. module 0..7). Up to eight additional modules can be connected. The address bits select e. g. single components on the modules (relays, LED-drivers, AD-converters etc.) The data bits write or read the information of these items.

2.1 HCE basic version

The basic version is equipped with only one 8-channel AD converter and the associated terminals.
In connection with external components or associated modules, the basic version can realize the following functions or operating modes:

- Bypass Summer / Winter operation
- Defroster heater (additional switch module required)
- Air duct heater (additional switch module required)
- Constant flow control

Connector pin assignment:

Plug X3-1 ***T1*** (NTC temp. sensor for intake air – MVHR inlet)

Plug X3-2 ***Defroster safety sensors*** (STB, flow sensor)

Plug X4 ***External control panel***

Plug X7-1 ***T5*** (NTC temp. sensor duct heater / heating circuit – duct temperature or flow temperature)

Plug X7-2 ***Safety sensors (electric) backup duct heater*** (STB, flow sensor)
There is no STB and no flow sensor if a hot water duct heater or water-based heating circuit is used.

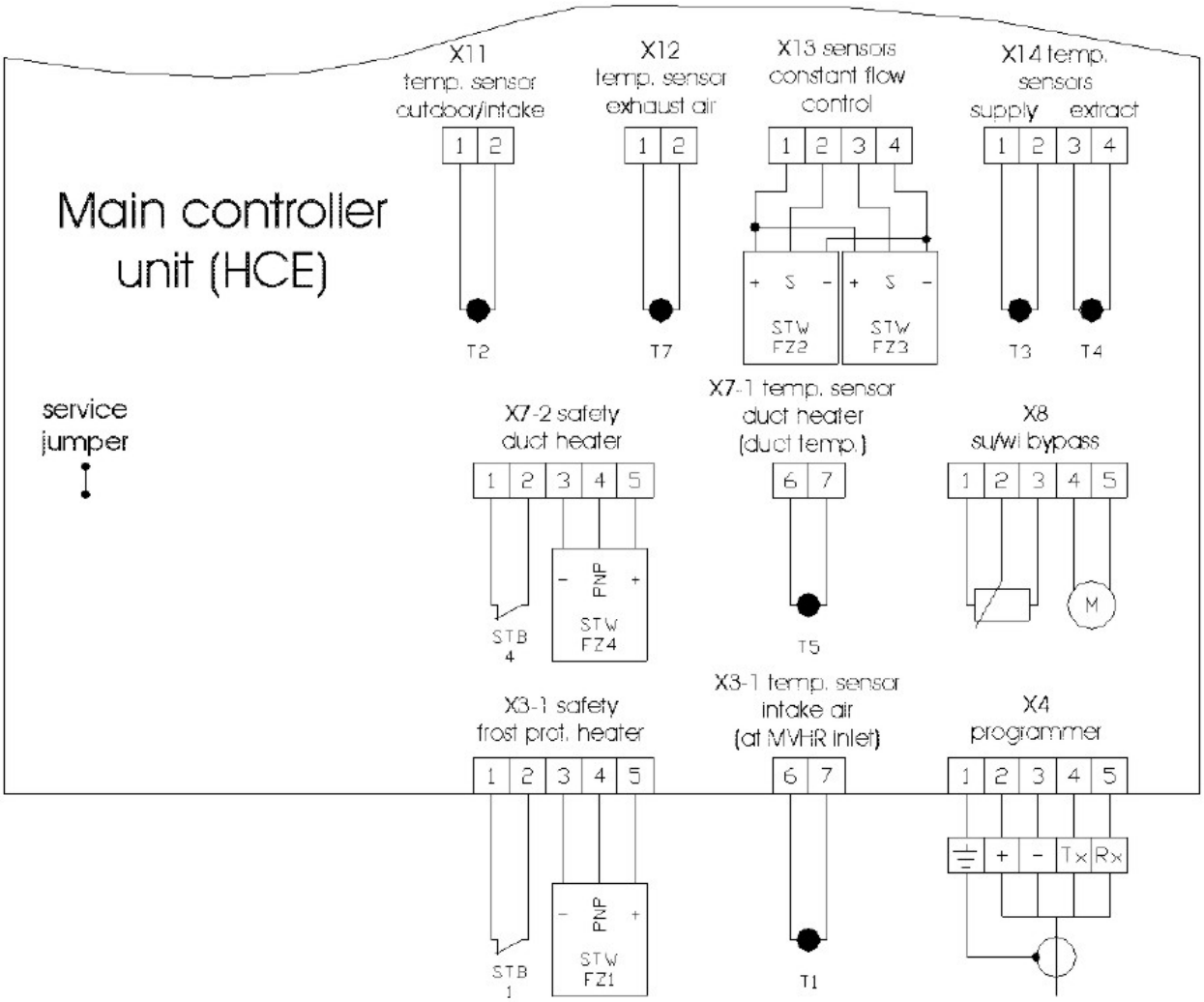
Plug X8 ***Bypass*** (Summer-Winter-bypass)

Plug X11 ***T2*** (NTC temp. sensor outdoor)

Plug X13 ***Flow sensors*** (Fz2-supply air, Fz3-extract air)
Only required for constant flow control!

Plug X14 ***T3*** (NTC temp. sensor for supply air), ***T4*** (NTC temp. sensor extract air)

2.2 Controller board terminal assignment



2.3 HCE technical data

The control system has been tested and validated by the manufacturer for the following components:

Temperature sensors T1 - T5	NTC-sensors 10 K (-30°C – 95°C)
Digital flow sensor	Make EGE, LN 520 GSP 24 VDC / 70 mA (Fz1 / Fz4)
Analog flow sensor	Make. EGE, LN 520 GA 24 VDC / 4 ... 20 mA (Fz2 / Fz3 sensors have to be calibrated by pairs for constant flow control)
Bypass motor	Make. Bosch, Type VMC, 24V with potentiometer (Type-No. 0132801141) Plug 192 840 3095 / socket contact AMP 962885-1

3. Power pack

The power pack is designed as a switch mode power supply with active power factor correction. It is shortcircuit-proof with open-circuit and overtemperature protection.
Optional feature: all 48 V and 24 V loads are switched off in standby mode.

Input voltage :	230 VAC, 50 Hz For fixed installation in building system, refer to electrical connection instructions
Fuses:	1-phase mains 1x16 A external 3-phase mains 3x16 A external internal mains fuse 2A M internal on power pack internal fuse for GHX flap or brine-defroster pump relay 0,1 A F on power pack
Output voltages :	48 VDC, 200 W 24 VDC, 24 W 12 VDC, 24 W
Thermal protection:	1. All loads are switched off by HCE when the first threshold is exceeded (approx. 65°C) → automatic restart when the control unit has cooled down 2. 24/48 VDC voltages from power pack are switched off when exceeding second threshold (80°C) → restart possible after disconnection from power mains
Standby (optional):	System switched off via control panel reduced power input (approx. 2W) for entire system in standby by active cutoff of all 24 and 48 V loads, standby mode selectable via control panel
Switching function:	Connection of 230 VAC / 0.1 A control phase for the regulating flap of the ground to air heat exchanger type Belimo, LM 230, or for relays controlling the brine-defroster pump
External connections:	Single or three-phase supply (max. 5 x 2.5 connection line) Voltage distribution for each phase 2 connections (L, N, PE) 1 x 48 VDC 200 W PWM1 and PWM2 for supply & extract fans Terminals for GHX regulating flap or brine-defroster pump control relay

4. Switch module 2,1 kW

The switch module is an universal module used to switch on an electric 230 VAC load with a maximum wattage of 2,1 kW.
The switch module is controlled via a 34-pin BUS-connector by the HCE.
The power pack supplies the module with 230 VAC load via voltage distribution terminals. When connecting the switch modules to the voltage distribution, pay attention that the individual phases are loaded symmetrically.
The load is directly connected via a 3 core cable to connector 2 of the power module. (inverted 3-pin connector)

To select the module's function, you have to put two jumpers for startup; each jumper must have the same position on the multi-pin connectors.

Functions

1=Defroster
2=Backup duct heater (electric / hot water) or heating circuit

!!! Both jumpers always have to be in the same position on the module. !!!

The hardware detection and module function assignment is done automatically via the BUS-line. Only one function can be assigned to one module. Eight different modules max. can be connected to the internal BUS.

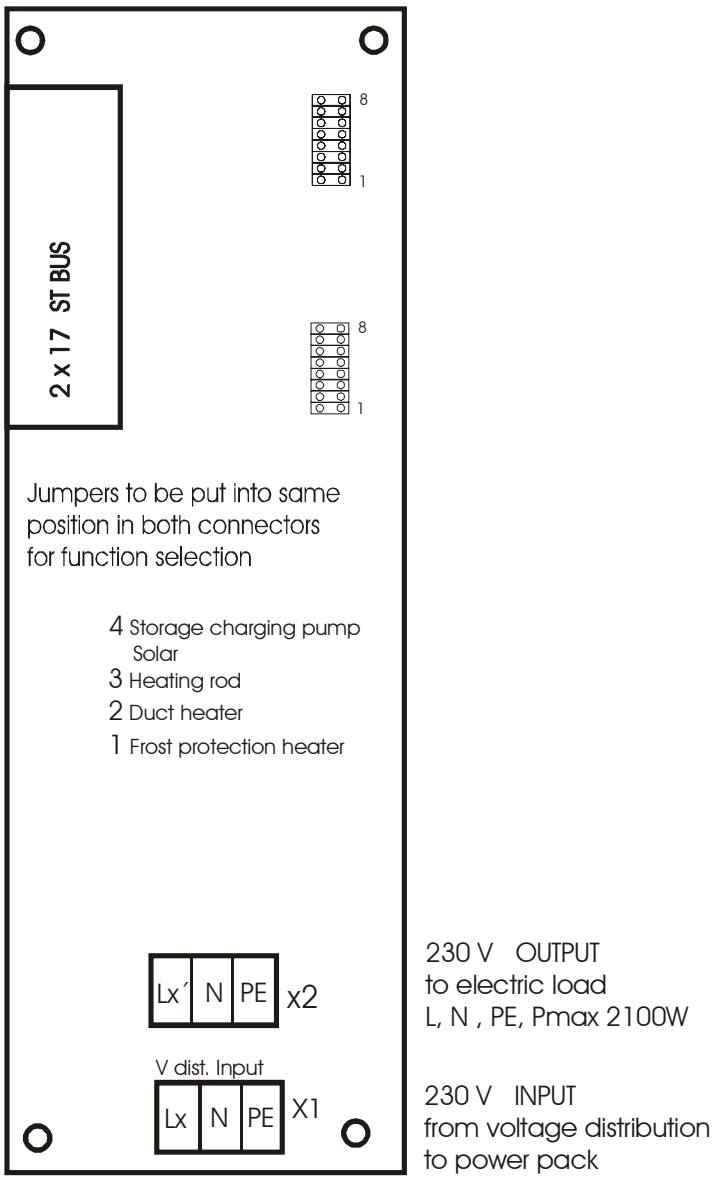
Connections to the power module:

X_1 **230 VAC – INPUT** 3-pin power supply, spring-type terminals

X_2 **230 VAC – switch output (2,1kW)** 3-pin, inverted socket with plug
Phoenix IC 2,5/3-G-5,08 / 1786417

4.1 Switch module terminal assignment plan

Switch module 2.1 KW



5. Control panel

The control panel (CP) consists of a two-piece wall mounting case with liquid-crystal display (LCD) and membrane keypad. 8 lines with max. 21 characters each can be displayed.
Date, time and room temperature are shown in line one.
The other lines inform the user about the operating mode (manual or automatic), the current ventilation step and the program activated.
A temperature sensor, which measures the room temperature, is integrated in the CP. It furthermore includes the connection for an external boost switch, an external temperature sensor and an additional CP.
Maximum 5 additional CPs can be connected in series.
Cable lengths between the control unit and the CP and the several CPs should not exceed 15 meters.
If it is intended to record the temperature in a room where no CP is installed, an external NTC sensor needs to be connected to the first CP. In this case, the NTC-Sensor in the lower left part of the CP has to be removed (cut off).
The temperature of the 1st CP is evaluated for backup duct heater and temperature indication.
Any parameters of the ventilation control unit can be viewed, entered and changed via the CP.
The operation is menu-driven, so all settings are self-explaining. The are different modes for user and service staff.
The user can only make a limited number of settings and validations.
The service staff can change any parameters via the menu System setup.
The service staff has the option to connect a second service CP to the 1st programmer. The service CP gives access to all parameters of each of the modules.
Settings can not be made with the service CP. To activate the service CP, a jumper has to be inserted into the two contacts next to the connector X1 on the HCE board.

5.1 Definition and adjustment of parameters and functions via control panel

Fans / Ventilation steps

Menu 9.7 Ventilation steps — Settings of ventilation steps and correction of supply/extract air values
Operating mode selection: PWM control or constant air flow

Heat pump and summer/winter bypass have to be disabled in Menu 1 Settings – Enable for the Blower-Door-Test.

Programs

Menu 5 Settings Programs — Setting of the ventilation steps for programs 1 to 8 in 15-minutes increments

---

Programs / day

Menu 5 Settings Programs / day — Assignment of the programs to the days of the week

---

Filter interval

Menu 5 Settings Filter change — Interval: xxx days (default: 90)
Range: 30 ... 250 days

Defroster

T7 Exhaust air temperature — x1 Defroster start temperature
H1 Hysteresis for x1

x1 → *Menu 9.0 Setup Defroster* — Defroster ON: T7 < x1
H1 → *Menu 9.0 Setup Defroster* — Hysteresis Defroster: H1

Duct heater / heating circuit

T0	Room temperature measured in 1st CP	x0	Room temp. setpoint
		H0	Hysteresis for x0
T5	Duct heater duct temp. or flow temp.	x5	max. duct temp. / flow temp.
		H5	Hysteresis for x5

x0 → *Menu 3 Settings Temperatures*
x5 → *Menu 9.5 Setup Duct heater*
H0 → *Menu 9.5 Setup Duct heater*
H5 → *Menu 9.5 Setup Duct heater*

Summer/winter bypass (not active)

T1	Intake air temp. at unit inlet	x4.1	T4max su/wi bypass
T4	Extract air temp	x4.2	T4min su/wi bypass
		H4	Hysteresis for x4.1 / x4.2

x4.1 → *Menu 9.1.0 Setup* su/wi bypass — *Bypass OPEN*: T4 > x4.1
x4.2 → *Menu 9.1.0 Setup* su/wi bypass — *Bypass OPEN*: T4 < x4.2

In Menu 9.1.1 Setup Bypass – motor — Definition of end positions for CLOSED (min) and OPEN (max)

GHX regulating flap/Brine-defroster pump

T2	Outdoor temperature	x2	min. temp. GHX flap OPEN / pump ON
		x4	max. temp. GHX flap OPEN / pump ON
		H2	Hysteresis for x2 and x4

x4 → *Menu 9.2.0 Setup GHX flap/Brine-defroster* regulating flap OPEN/pump ON: T2 > x4
x2 → *Menu 9.2.0 Setup GHX flap/Brine-defroster* regulating flap OPEN/pump ON: T2 < x2

Plausibility range of the temperatures T0 – T5 -30 ... 95 °C

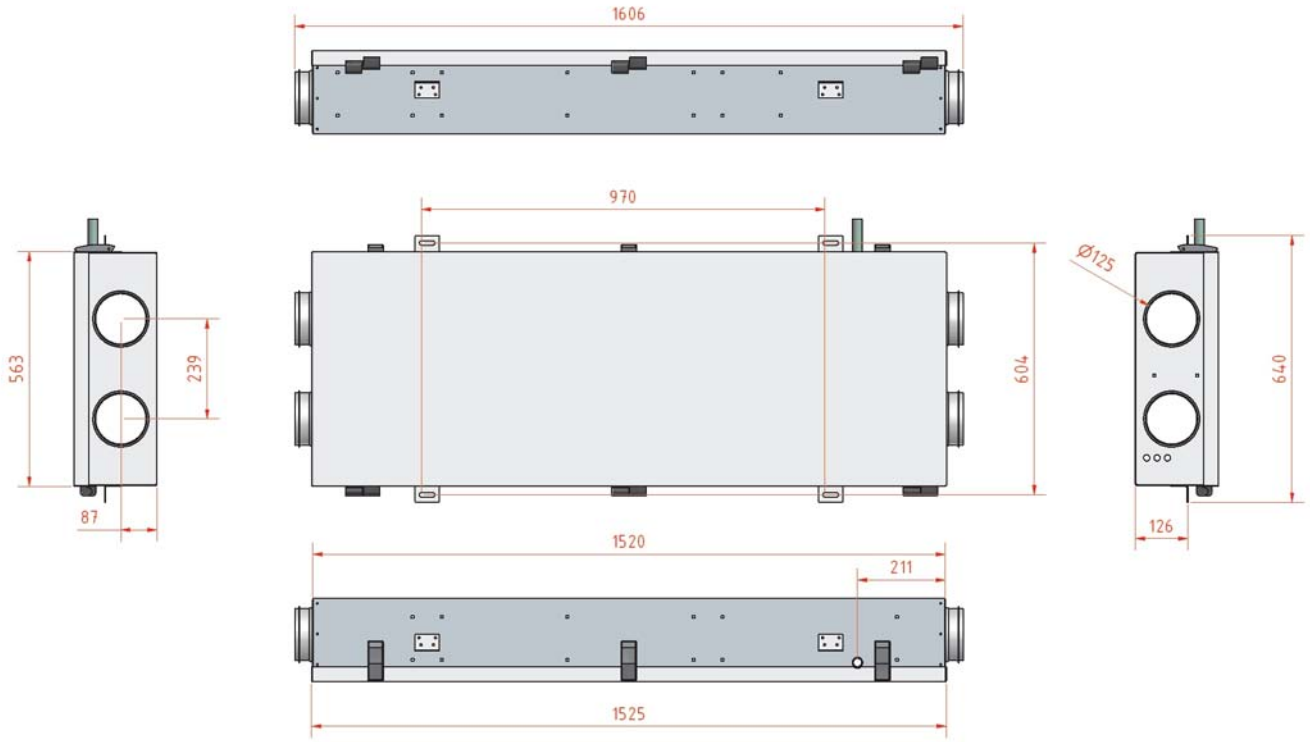
Setting parameter specifications:

X0	20,0°C	(00,0 ... 35,0°C)	Room temperature setpoint
X1	02,0°C	(-10,0 ... 50,0°C)	Defroster start temperature
X2	05,0°C	(00,0 ... 10,0°C)	Tmin GHX flap OPEN Tmin brine-defroster pump ON
X4	25,0°C	(15,0 ... 35,0°C)	Tmax GHX flap OPEN Tmax brine-defroster pump ON
X4.1	24,0°C	(20,0 ... 35,0°C)	Tmax Su/wi bypass OPEN
X4.2	18,0°C	(00,0 ... 20,0°C)	Tmin Su/wi bypass CLOSED
X5	50,0°C	(20,0 ... 60,0°C)	max. duct temp. / flow temp.
H0	0,5K	(00,0 ... 5,0K)	Hysteresis room temperature setpoint
H1	0,5K	(00,0 ... 5,0K)	Hysteresis defroster
H2	1,0K	(00,0 ... 5,0K)	Hysteresis GHX flap/Brine-defroster
H3	1,0K	(00,0 ... 5,0K)	Hysteresis supply air temperature
H4	1,0K	(00,0 ... 5,0K)	Hysteresis (00,0 ... 5,0°C)
H5	1,0K	(00,0 ... 5,0K)	Hysteresis duct temp. / flow temp.

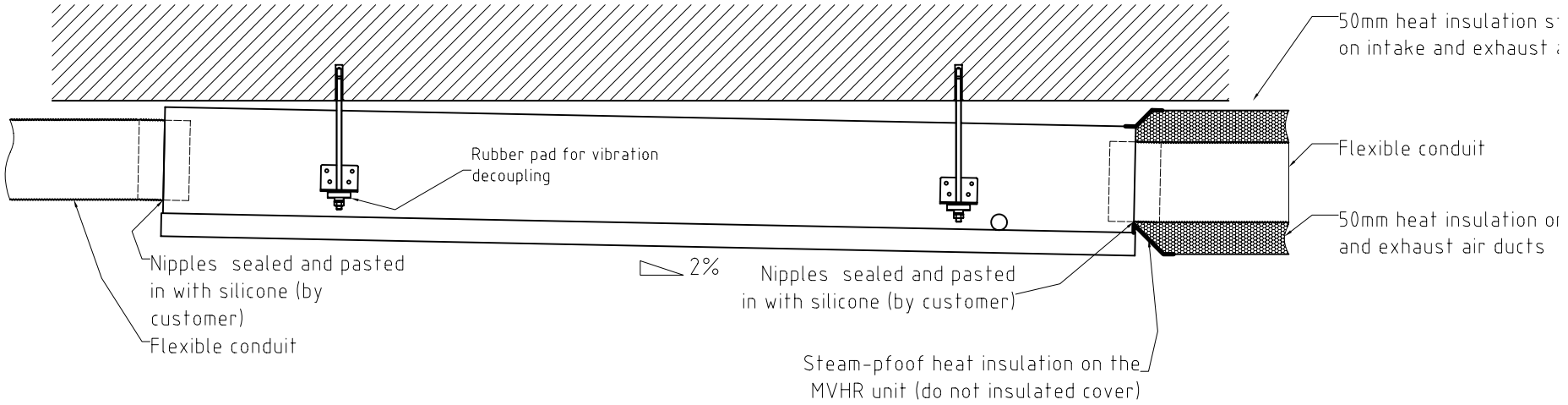
	min	max	
Su/wi bypass	118	222	individual values are always depending on unit!

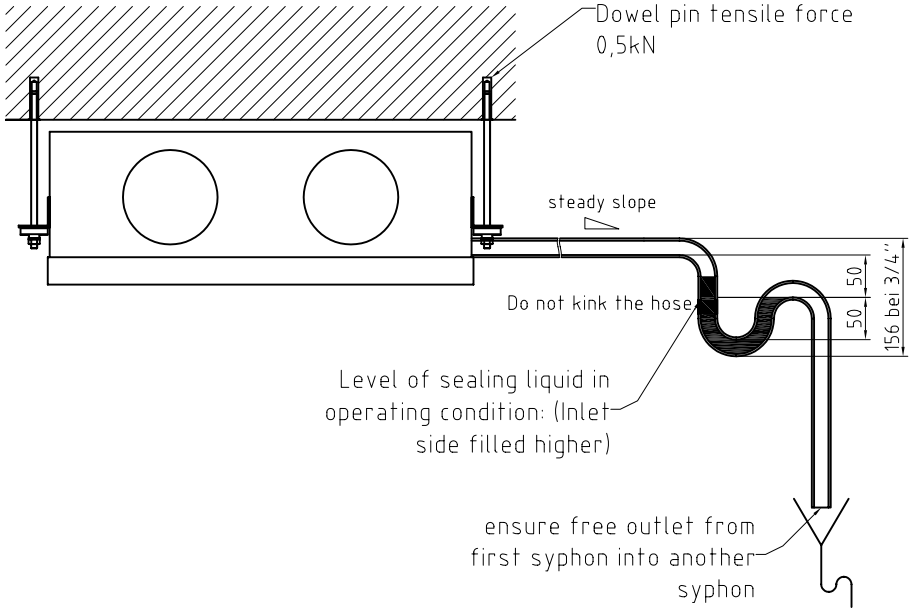
Filter interval 30 ... 250 days

Temperature Night economy (0,0 ... 5,0K)



Appendix A Dimension MVHR unit climos





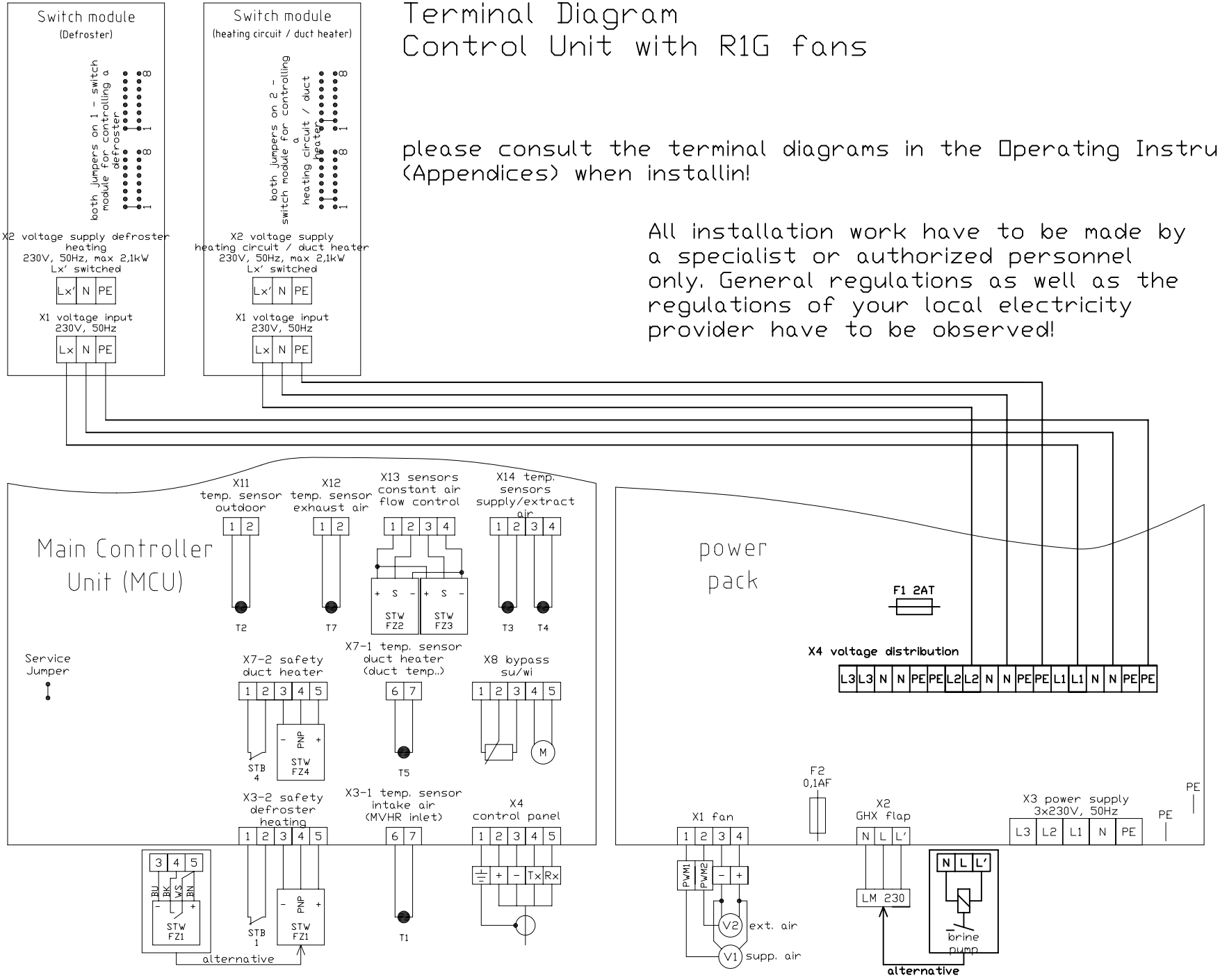
Install unit with steady slope of 2% to the condensate drain. Install condensate drain hose form unit outlet with steady slope. Make sure that there are no kinks in the condensate drain hose. Observe the elevation differences in the sketch when installing the syphon. The syphon has to be filled with water when starting up the unit. The MVHR unit and the condensate drain have to be installed in a frost-protected room.

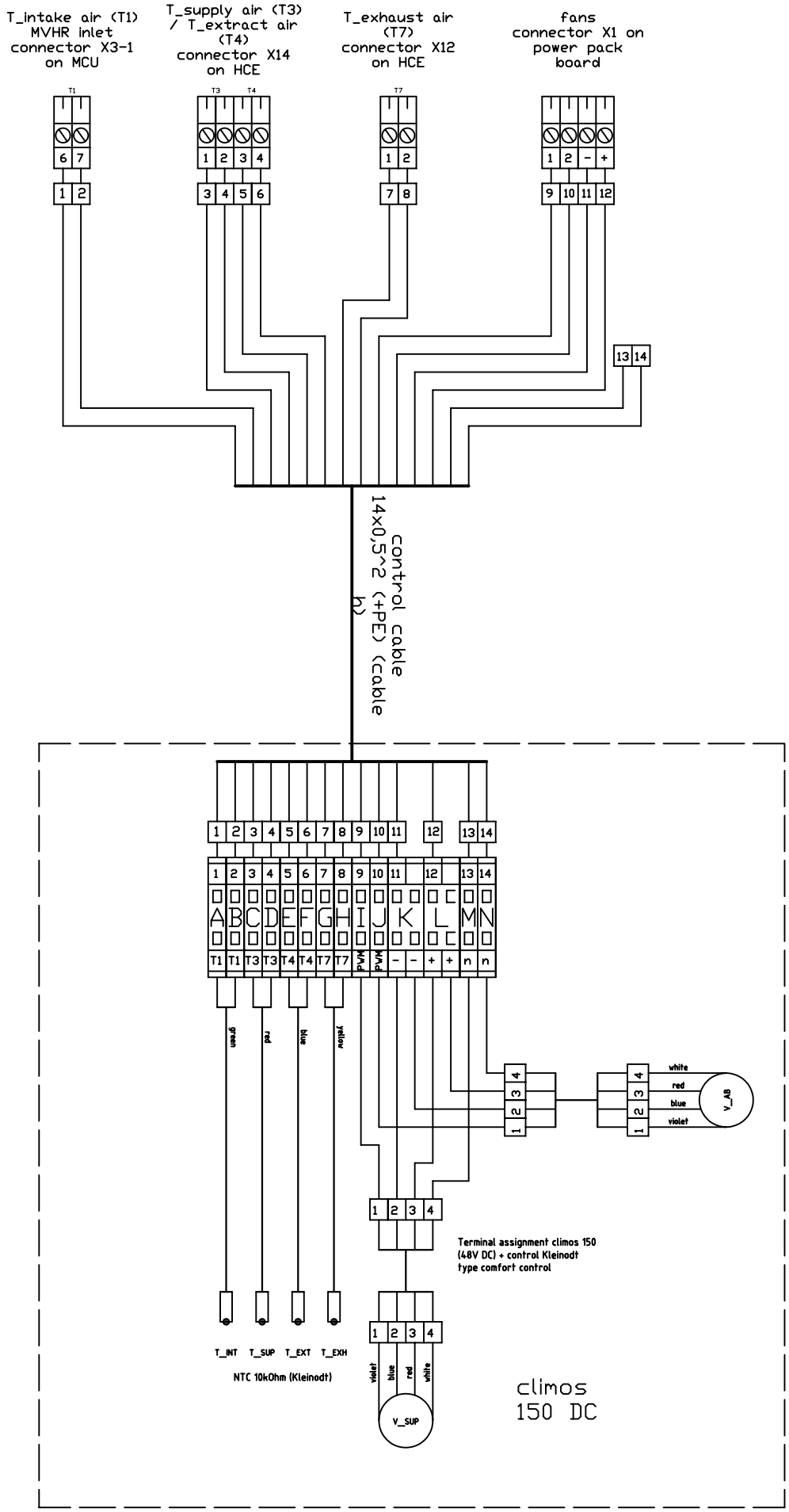
The air ducts have to be flexible. Intake and exhaust air ducts have to be insulated with 50mm heat insulation (steam-proof). We recommend installing the heat insulation before installing the MVHR unit in the false ceiling.
Connect the air ducts to the MVHR unit using DN 125 nipples, which sealed and are pasted in the unit with silicone.

Terminal Diagram
Control Unit with R1G fans

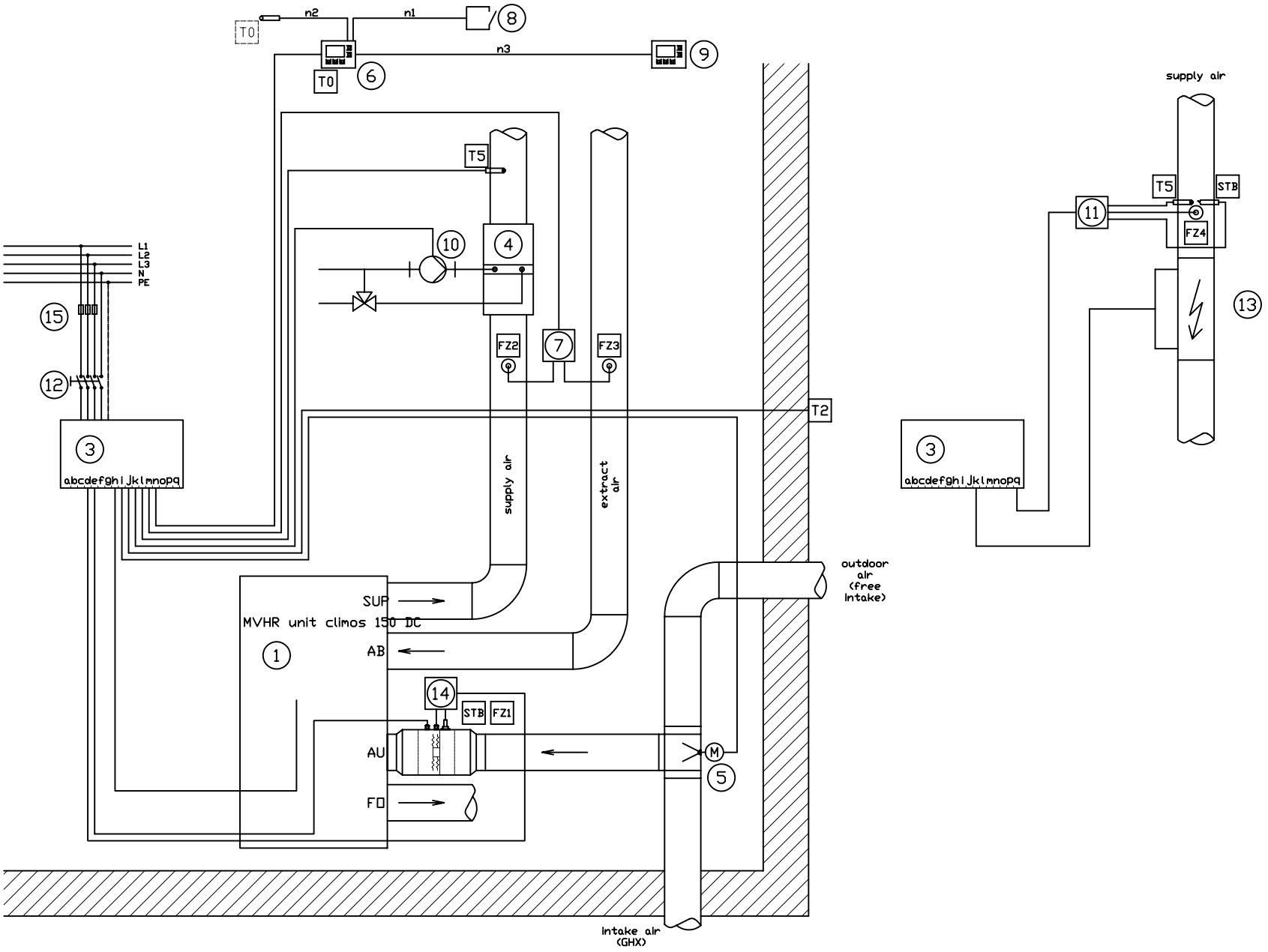
please consult the terminal diagrams in the Operating Instructio (Appendices) when installin!

All installation work have to be made by a specialist or authorized personnel only. General regulations as well as the regulations of your local electricity provider have to be observed!





Appendix 1.2 Internal terminal diagram climos 150 DC



Appendix 2.1 External connection diagram climos 150 DC

Status 27.08.09 We reserve the right to make changes favouring technical progress.		**Appendix 2.2** **Legend cable diagram climos 150 DC**	PAUL WÄRMERÜCKGEWINNUNG
①	climos	Mechanical ventilation heat recovery	
②		not used	
③	Control unit	Modular-constructed control unit, system-specific configuration; integrated control and power electronics	
④	hot water backup duct heater, (alternative: electric backup duct heater)	Use of hot water backup duct heater which can be controlled hydraulically via a thermostatic mixer. The duct temperature is detected by sensor T5.	
⑤	GHX regulating flap **alternative:** Pump brine-defroster	For change-over from direct fresh air intake to GHX intake For pump control for pre-heating/cooling of intake air with brine-defroster	
⑥	Control panel	Control panel installed in the reference rooom for manual input of user parameters, sensor T0 monitorinf room temperature integrated (alternatively, remote sensor connectable), additional control panels can be connected; 1st control panel is used for temperature detection	
⑦	Constant flow control	For automatic balancing of incoming and outgoing air flows via analog flow sensors	
⑧	Boost switch	For manual boost ventilation (limited in time) – commercial switch	
⑨	Additional Control Panel	Fully functional control panel (except for room temperature detection)	
⑩	Pump for hot water backup duct heater	For feeding the hot water backup duct heater, switched on and off by control unit	
⑪	Sensor technology electric backup duct heater	Consists of flow indicator, thermal cut-out and duct temperature sensor for monitoring the electic duct heater	
⑫	Power supply	Single to 3-phase (acc. to connected load, e.g. electric duct heater, defrioster heater...), depending on system configuration; maintenance, service or master switch has to be provided by customer for disconnection of primary power	
⑬	Electric backup duct heater	For direct electrical heating of the air as an alternative to hot water backup duct heater. If using an electric backup duct heater, sensor technology (⑪) is absolutely necessary. The electric backup duct heater is connected instead of the pump for hot water backup duct heater. The electric power is limited to 2,1 kW.	
⑭	Defroster preheater	Alternative to the GHX for frost protection of the MVHR	
⑮	Power circuit breaker	Power circuit breaker 16A	
T0	Room temperature sensor	In the control panel, or alternative separate sensor in a reference room, for recording the reference room temperature used for switching on or off the duct heater	
T2	Outdoor temperature sensor	For detecting the outdoor temperature in connection with changeover between direct air intake and intake via ground to air heat exchanger	
T5	Duct temperature sensor	For detecting the duct temperature when a hot water backup duct heater is used, or part of the sensor technology of the electric backup duct heater for detecting the duct temperature (limitation to 50°C)	
FZ2	analog supply air flow sensor	For detecting the volumetric flow of the supply air	
FZ3	analog extract air flow sensor	For detecting the volumetric flow of the extract air	
FZ4	Duct heater flow indicator	Part of the sensor technology of the electric backup duct heater for detecting the minimum flow rate required	
STB	Thermal cut-out supply air duct heater	Part of the sensor technology of the electric backup duct heater for limitation of the maximum temperature	

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Status 27.08.09 We reserve the right to make changes favouring technical progress.	Appendix 2.3 Cable description climos 150 DC	PAUL WÄRMERÜCKGEWINNUNG

Cable	Description	Type	Number of wires	Cross section	Voltage	Note	Cable length
d	230V supply voltage control unit – defroster heater	Central PVC hose line H05VV-F 3G 1,5	3	1,5mm²	230 VAC	Cable with prefabricated plug	3m
e	Sensor line Safety group Defroster heater – control unit	Control line YSLY-JZ	5	0,5mm²	24V DC	Prefabricated cable, place on connector X3 on HCE board for startup (see terminal diagram multi 150 DC)	3m
h	Control line Control unit	Control line YSLY-JZ	14+PE	0,5mm²	48V DC	Cable with prefabricated plug	3m from MVHR outlet
i	230V supply voltage Control unit – GHX regulating flap **alternative:** Control unit – brine pump	Central PVC hose line H05VV-F 3G 1	3	1mm²	230V AC	Appropriate cable has to be installed by customer; refer to terminal diagram for connection	appropriate length to be laid by customer
j	Sensor line T2 – Control unit	Copper strand with PVC insulation LiYY	2	0,5mm²	5V DC	Prefabricated sensor with cable and plug (insert only when using a GHX flap or brine-defroster operated by the control unit)	5m
k	Supply voltage Control unit – backup duct heater (pump or direct electric)	Central PVC hose line H05VV-F 3G 1,5	3	1,5mm²	230V AC	Appropriate cable has to be installed by customer; refer to terminal diagram for connection	appropriate length to be laid by customer
l	Sensorleitung T5-Steuerung	Copper strand with PVC insulation LiYY	2	0,5mm²	5V DC	Prefabricated sensor with cable and plug (only when using a heating circuit whose pump is operated by the control unit)	5m
m	Control line Control unit – flow sensors	Control line YSLY-JZ	4	0,5mm²	24V DC	Appropriate cable has to be installed by customer; refer to terminal diagram for connection	appropriate length to be laid by customer
n	Control line Control unit – Control panel	Shielded control line J-Y(St)Y	4	0,6mm	5V DC	Appropriate cable has to be installed by customer; refer to terminal diagram for connection	appropriate length to be laid by customer
n1	Control line boost switch-Control panel	Shielded control line J-Y(St)Y	4	0,6mm	5V DC	Appropriate cable has to be installed by customer; refer to terminal diagram for connection	appropriate length to be laid by customer
n2	Sensor line ext. room temp. - (first) control panel	Copper strand with PVC insulation LiYY	2	0,5mm²	5V DC	Prefabricated sensor installation in flush socket (insert only when control panel can not be installed in the reference room)	appropriate length to be laid by customer
n3	Control line control panel – control panel	Shielded control line J-Y(St)Y	4	0,6mm	5V DC	Appropriate cable has to be installed by customer; refer to terminal diagram for connection	appropriate length to be laid by customer
q	Control line Control unit – electric backup duct heater	Control line YSLY-JZ	7	0,5mm²	5/24V DC	Prefabricated sensor with cable and plug (only when using a n electric backup duct heater operated by the control unit)	5m

- Do not install 230 V AC and 5...48 V DC cables / sensor cables next to each other or in the same cable duct, because this might disturb the sensor elements. We recommend a minimum distance of min. 30 cm.
- Install all cables in a cable conduit or a cable duct. Use cable conduits in wall penetrations.
- If the customer installs the cables, the cable types specified in the table, or equivalent types, have to be used.
- Do not attach temperature sensors next to the heat shrinking sleeve (esp. inside a cable duct).
- Make sure the system is voltage-free before connecting or removing any plug connections.
- It depends on the electrical load whether the primary power has to be installed single-phase or multi-phase. Generally, a single-phase connection is sufficient when using the ventilation unit and maximum one assembly (defroster heating or electrical backup duct heater). If there are two assemblies installed, which are directly connected and supplied by the control unit, a multi-phase connection has to be made. Ref. Appendix 2.5 "Electrical connection climos 150 DC".
- The primary power has to be equipped with a circuit breaker.
- All maintenance and service work has to be done when system is de-energized. De-energize system before opening control unit.

All installation work have to be performed by an electronic technician or authorized personnel only. Keep to the general regulations as well as the regulations of your local electricity provider.

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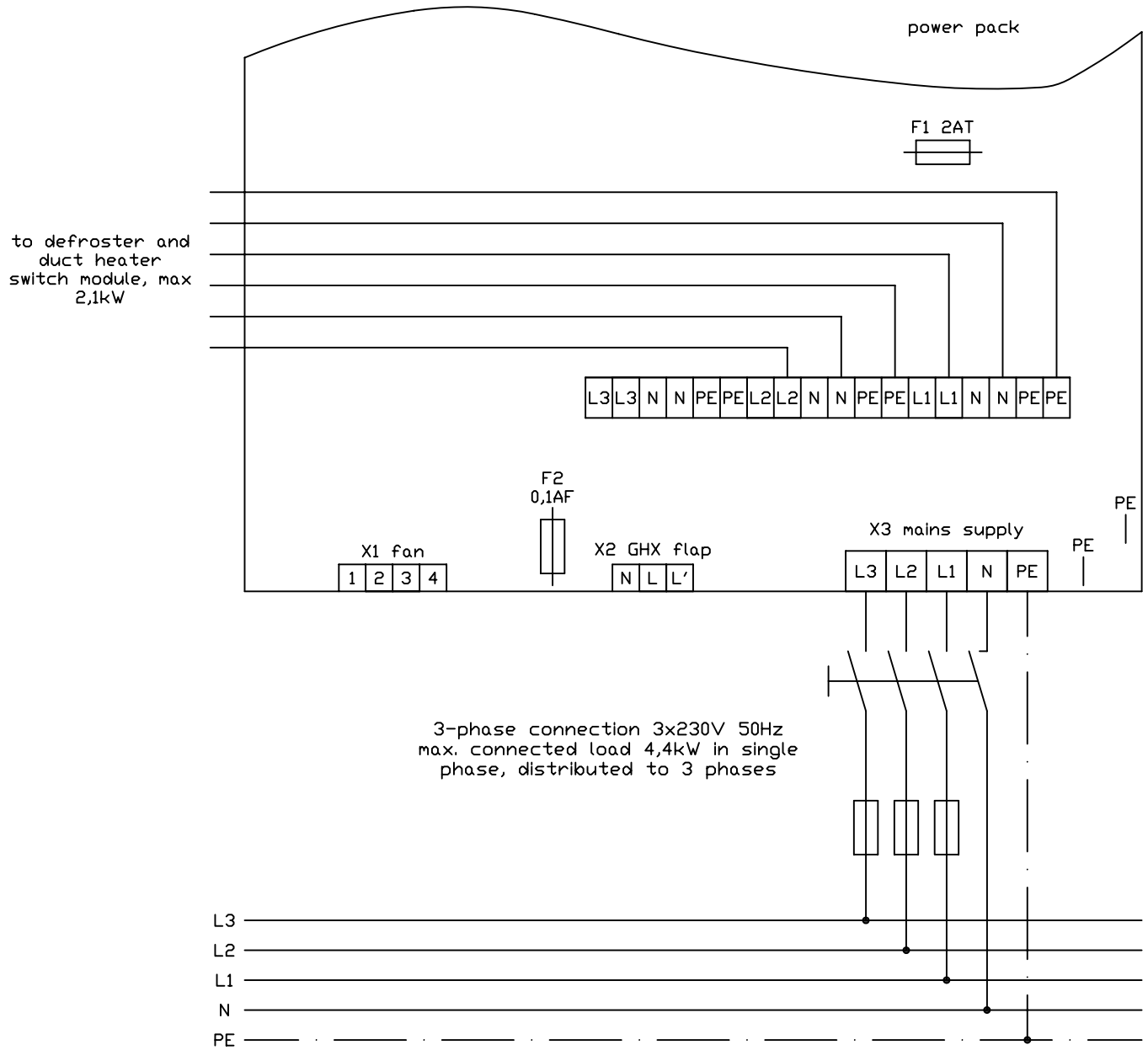
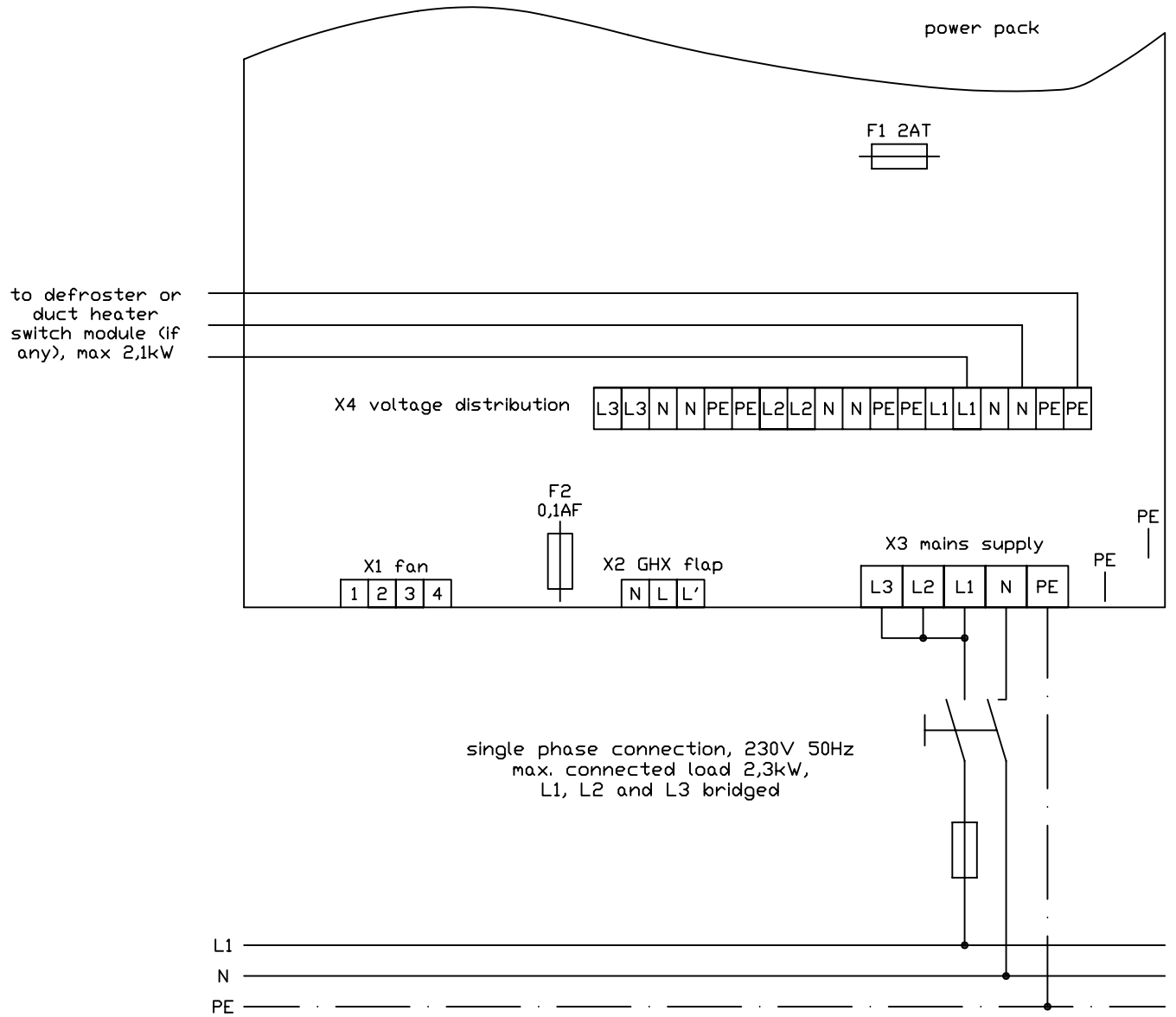
3-phase connection



single phase connection



All installation work have to be made by a specialist or authorized personnel only. General regulations as well as the regulations of your local electricity provider have to be observed!

Heating circuit dimensioning example
Dimension: min. DN 15

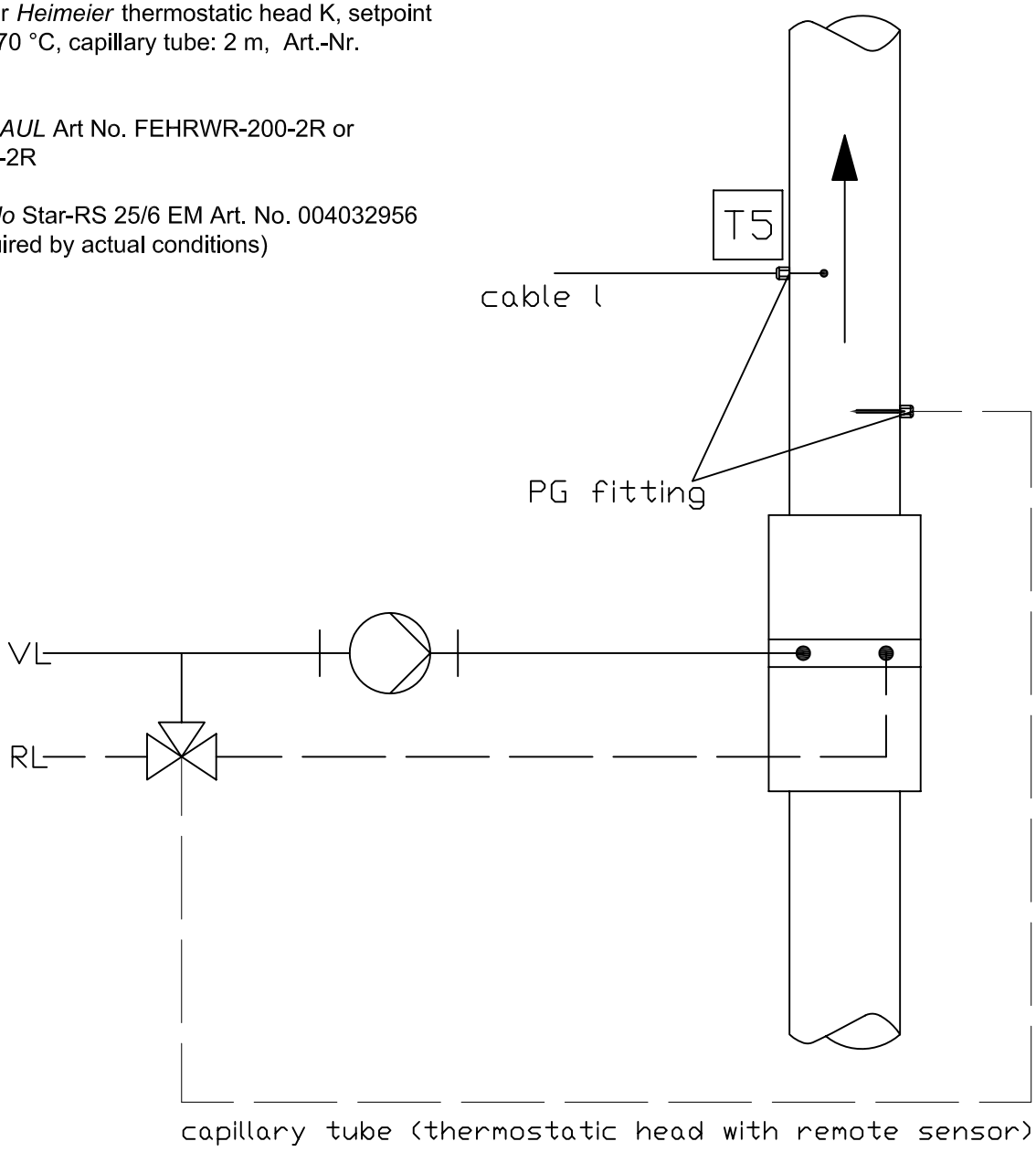
Nominal pressure of interior components: min. PN 6

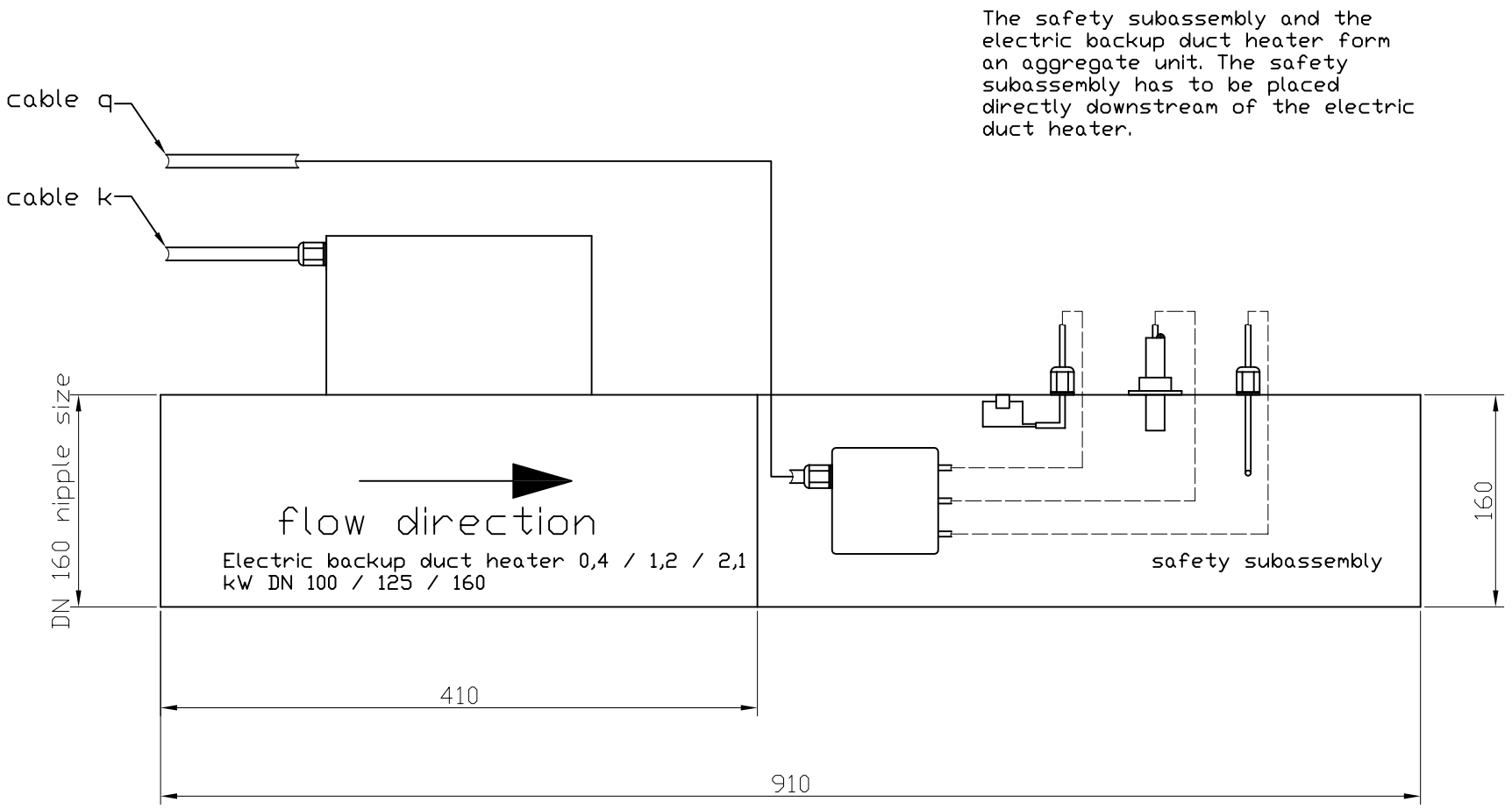
Mixer: e.g. *Heimeier* three-way reversing valve DN15, Art. No. 4160-02.000

Thermostatic head: e.g. *Heimeier* thermostatic head K, setpoint range 20 °C - 50 °C, capillary tube: 2 m, Art No. 6402-00.500 or *Heimeier* thermostatic head K, setpoint range 40 °C - 70 °C, capillary tube: 2 m, Art.-Nr. 6602-00.500

Duct heater: *PAUL* Art No. FEHRWR-200-2R or FEHRWR-250-2R

Pump: e.g. *Wilo* Star-RS 25/6 EM Art. No. 004032956 (select as required by actual conditions)

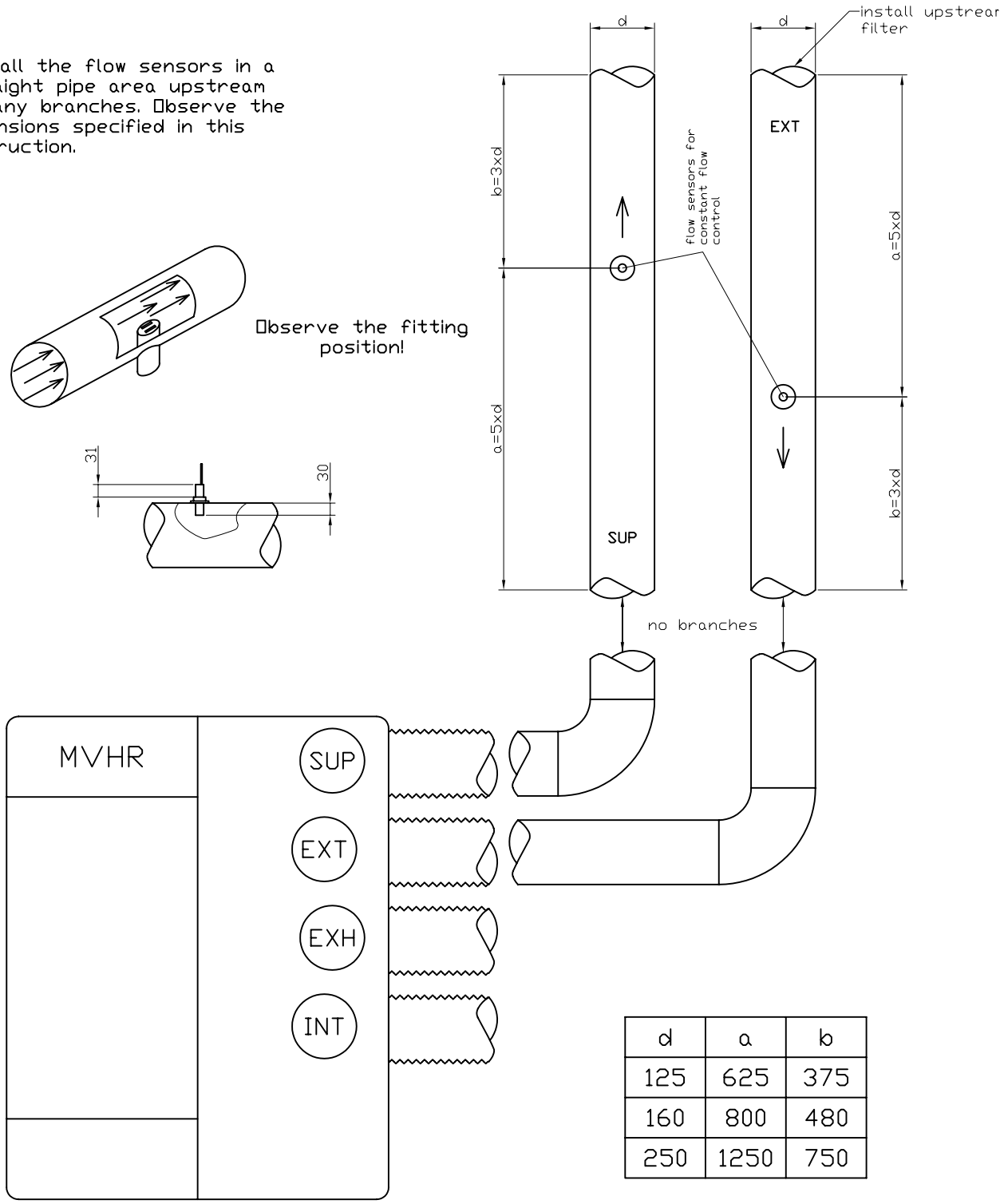



The safety subassembly and the electric backup duct heater form an aggregate unit. The safety subassembly has to be placed directly downstream of the electric duct heater.
cable q
cable k
DN 160 nipple size
flow direction
Electric backup duct heater 0,4 / 1,2 / 2,1 kW DN 100 / 125 / 160
safety subassembly
160
410
910

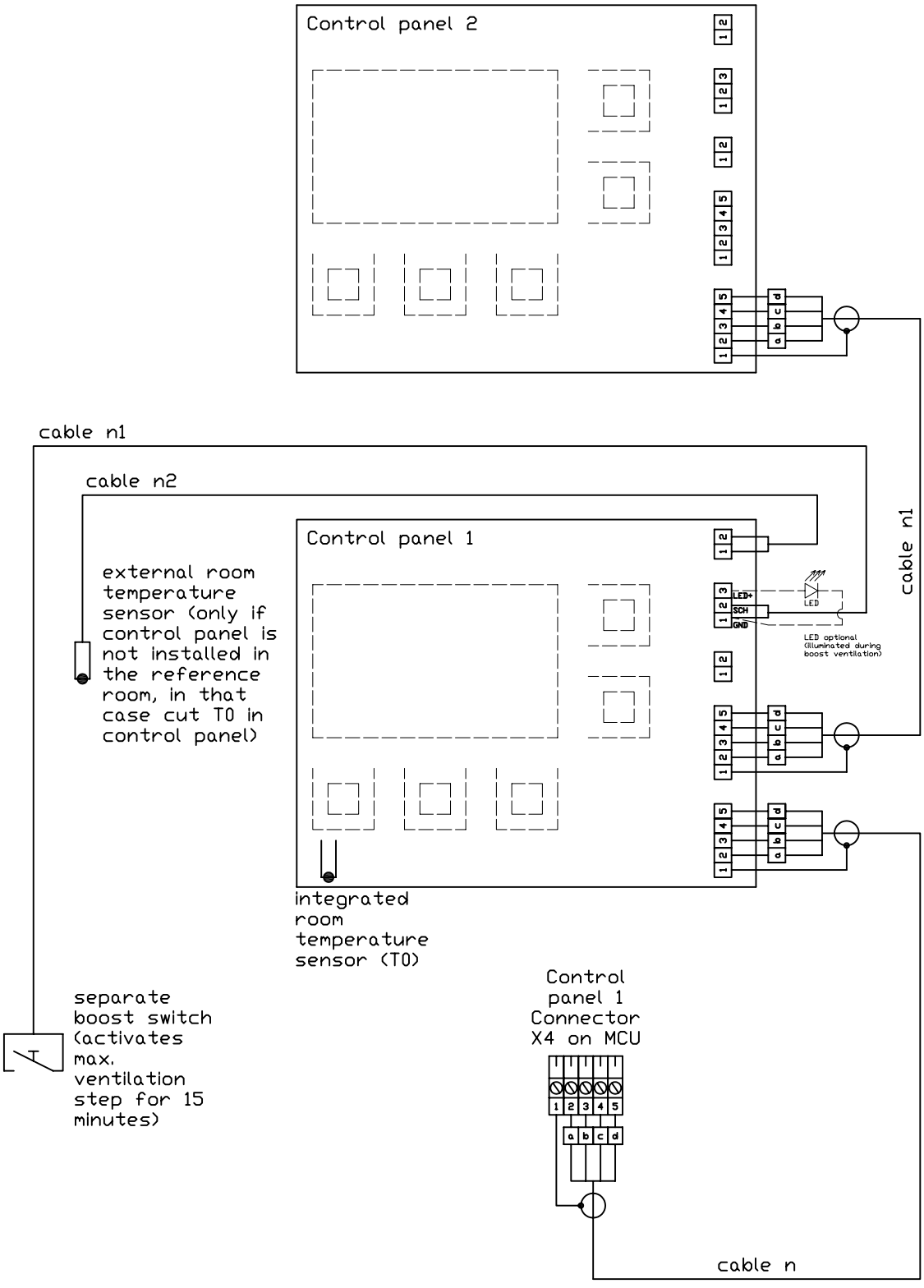
Appendix 3.2 Installation instructions for electric back-up duct heater

Install the flow sensors in a straight pipe area upstream of any branches. Observe the dimensions specified in this instruction.

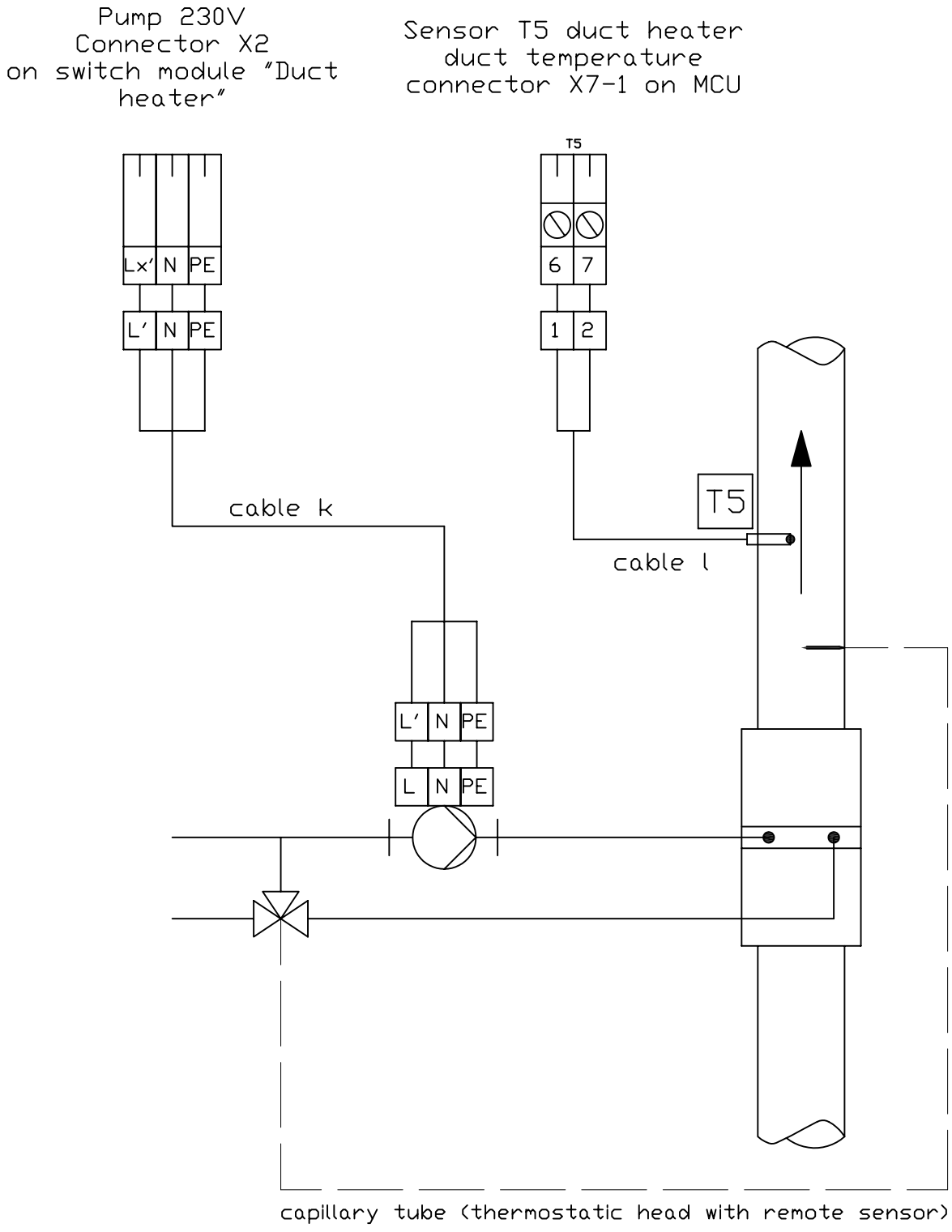
Observe the fitting position!



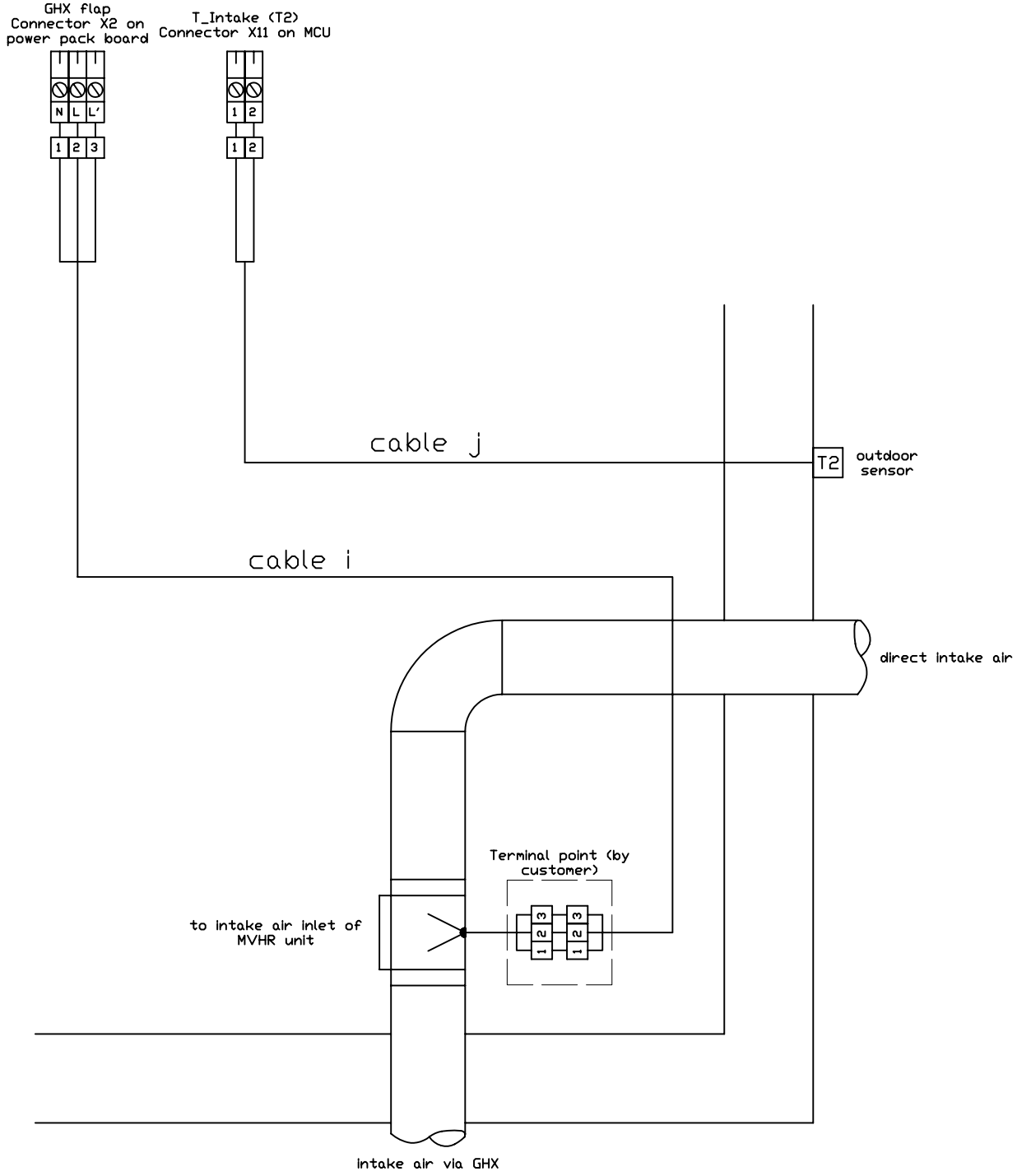
d	a	b
125	625	375
160	800	480
250	1250	750


Control panel 2
cable n1
cable n2
Control panel 1
external room temperature sensor (only if control panel is not installed in the reference room, in that case cut T0 in control panel)
LED+
SCH
GND
LED
LED optional (illuminated during boost ventilation)
cable n1
integrated room temperature sensor (T0)
separate boost switch (activates max. ventilation step for 15 minutes)
Control panel 1 Connector X4 on MCU
cable n

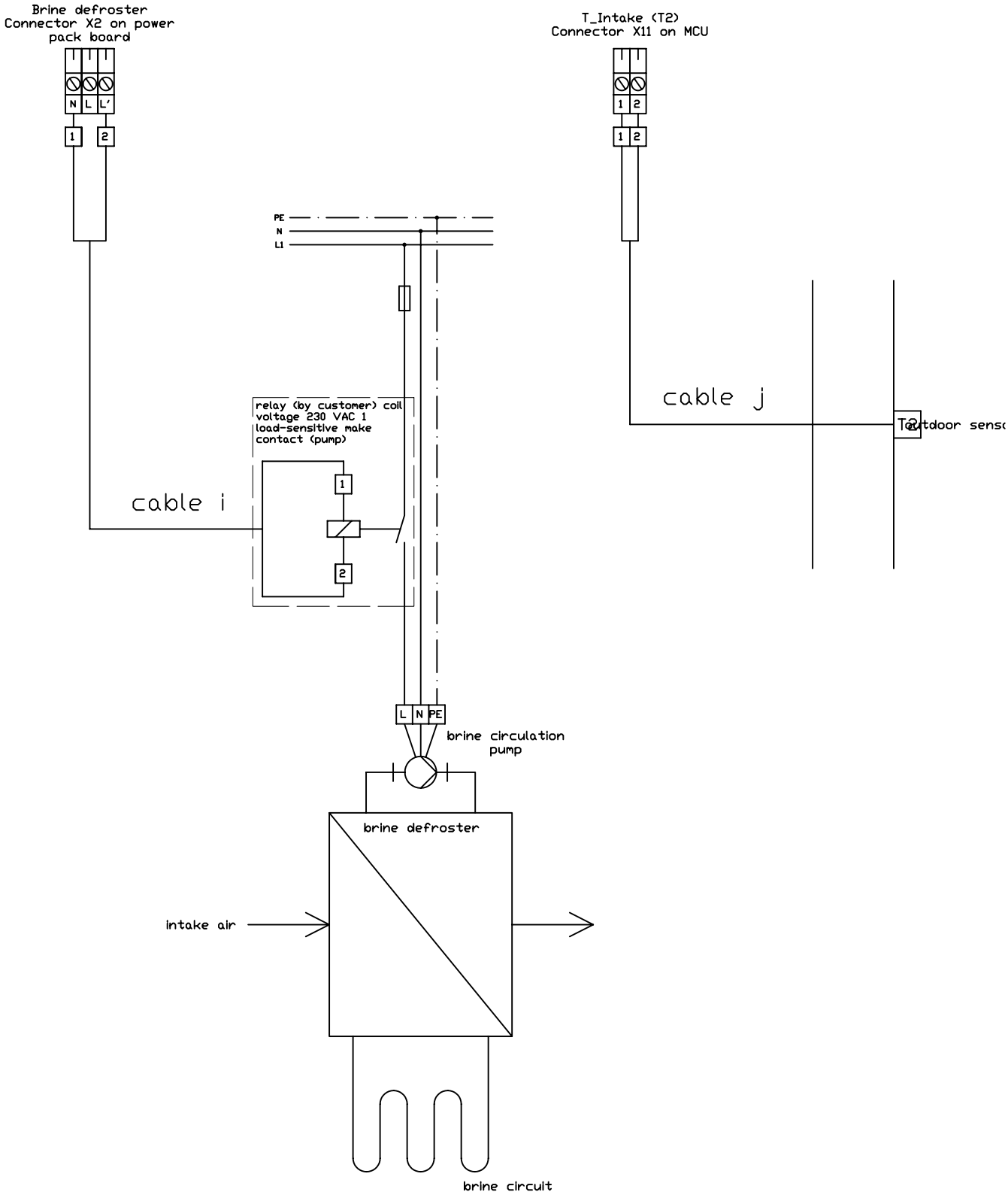
Appendix 4.1 Cabling of control station



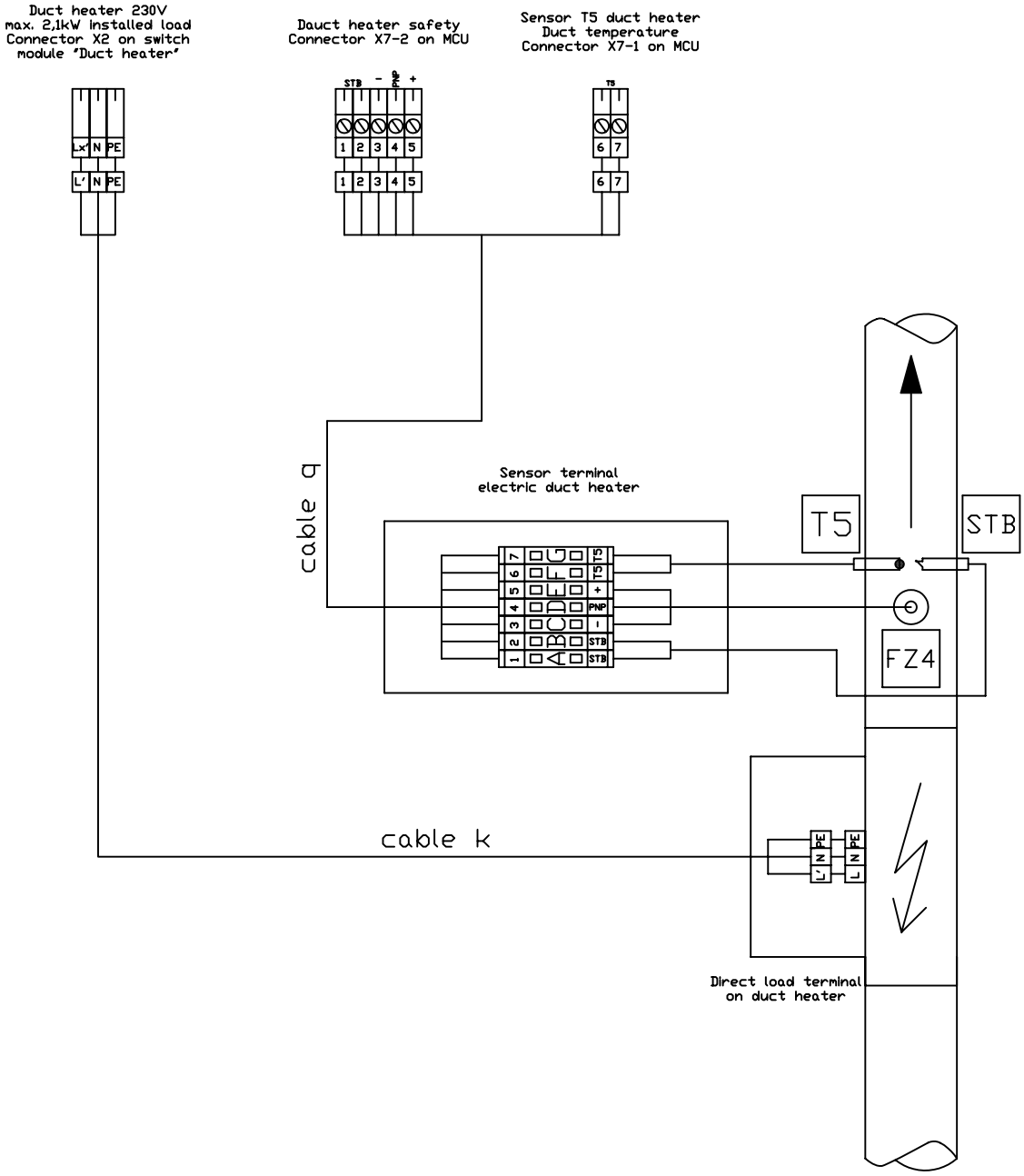
Appendix 4.2 Cabling of hot water back-up duct heater pump



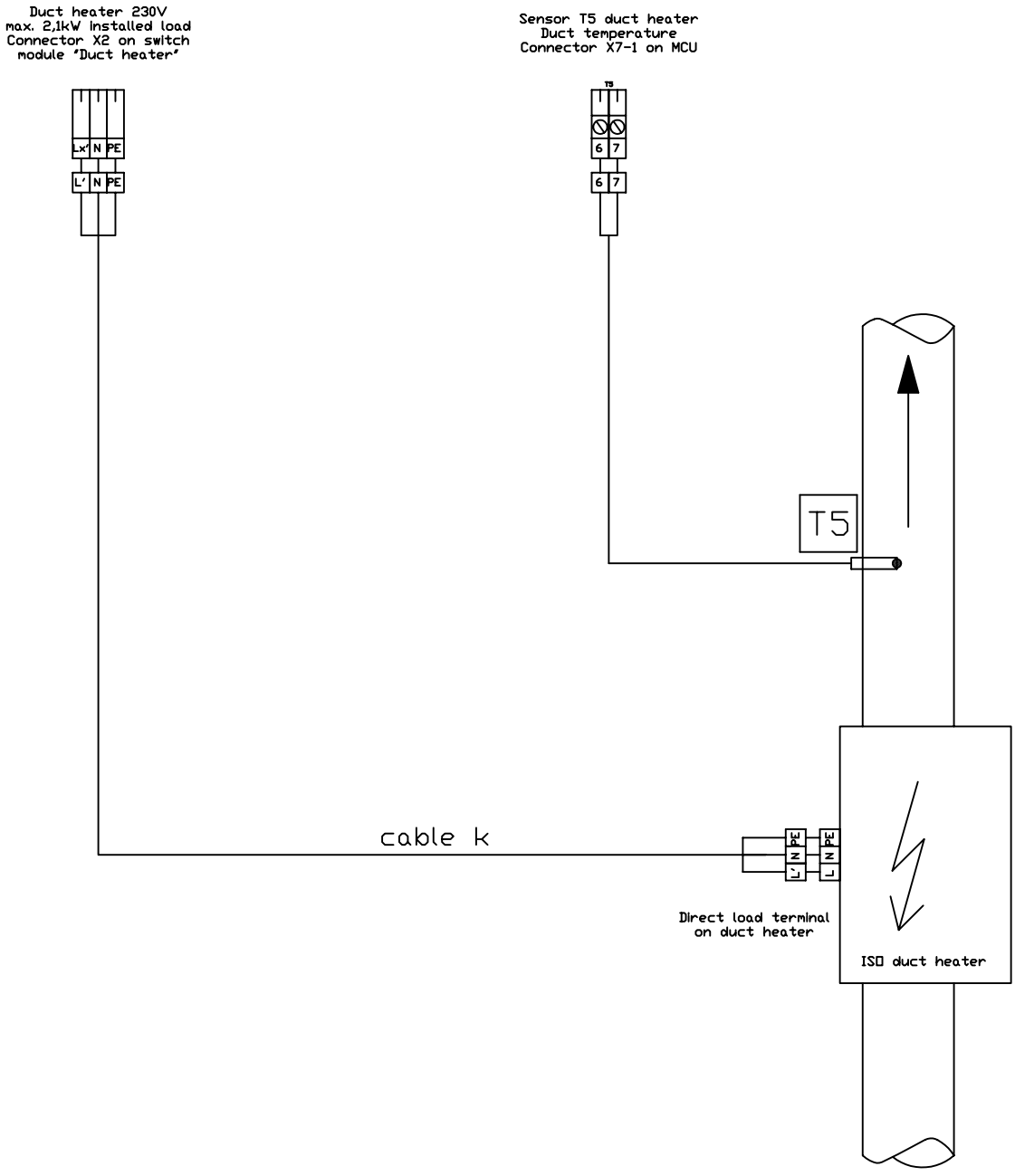
Appendix 4.3 Cabling of GHX valve



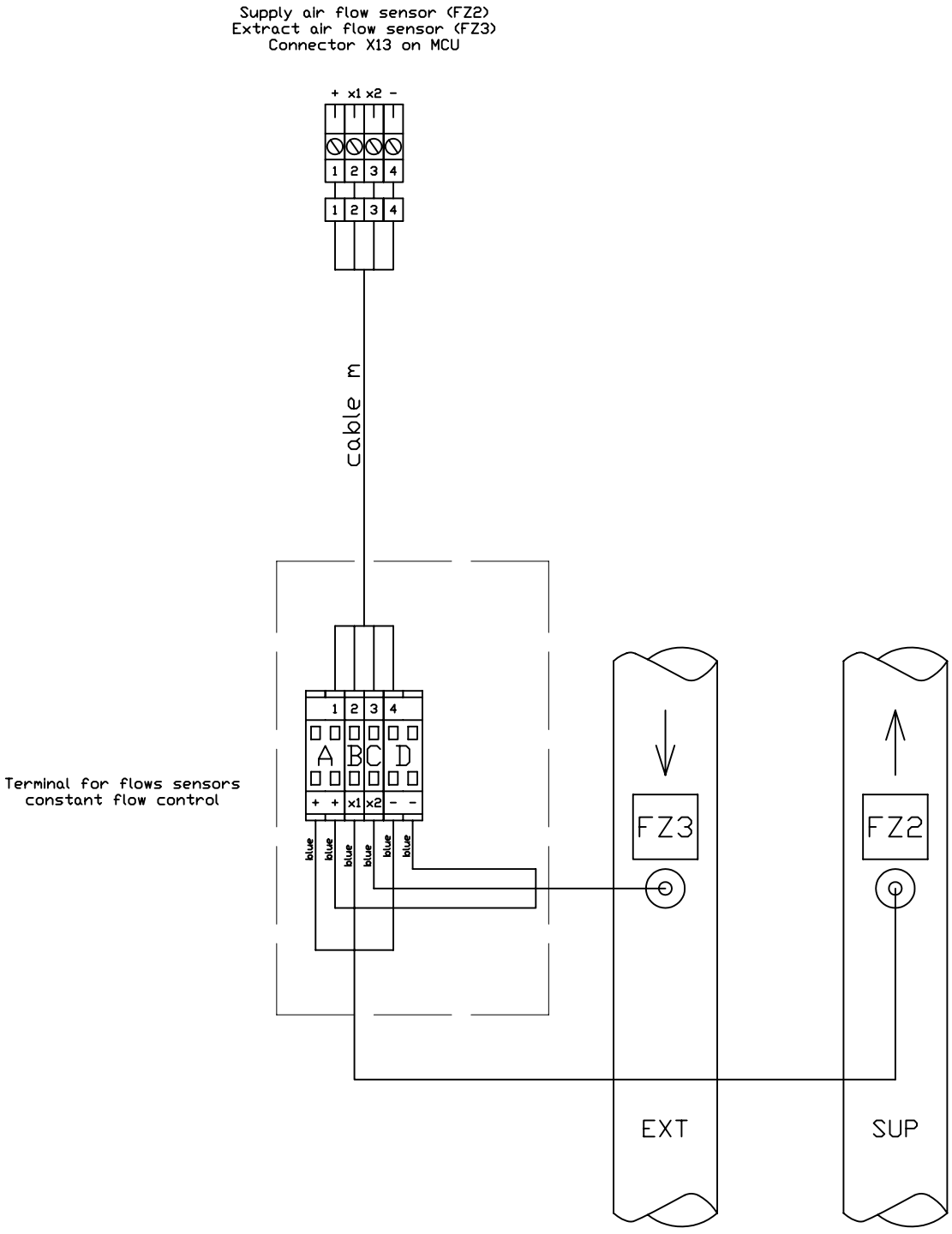
Appendix 4.3.a Cabling of brine-defroster pump



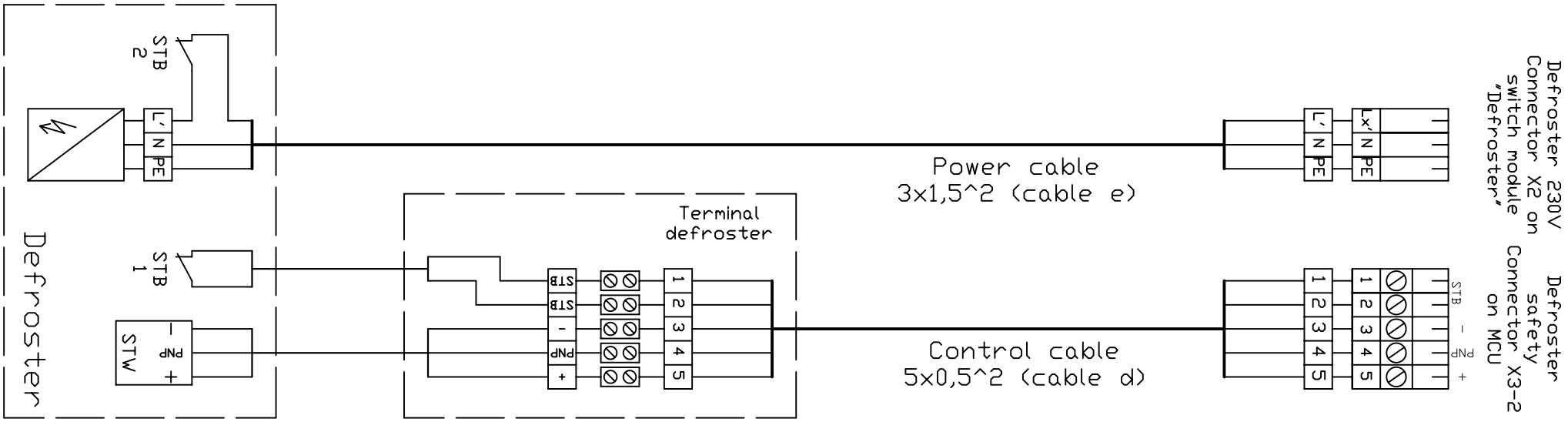
Appendix 4.4.a Cabling of electric duct heater with ohmic heating element



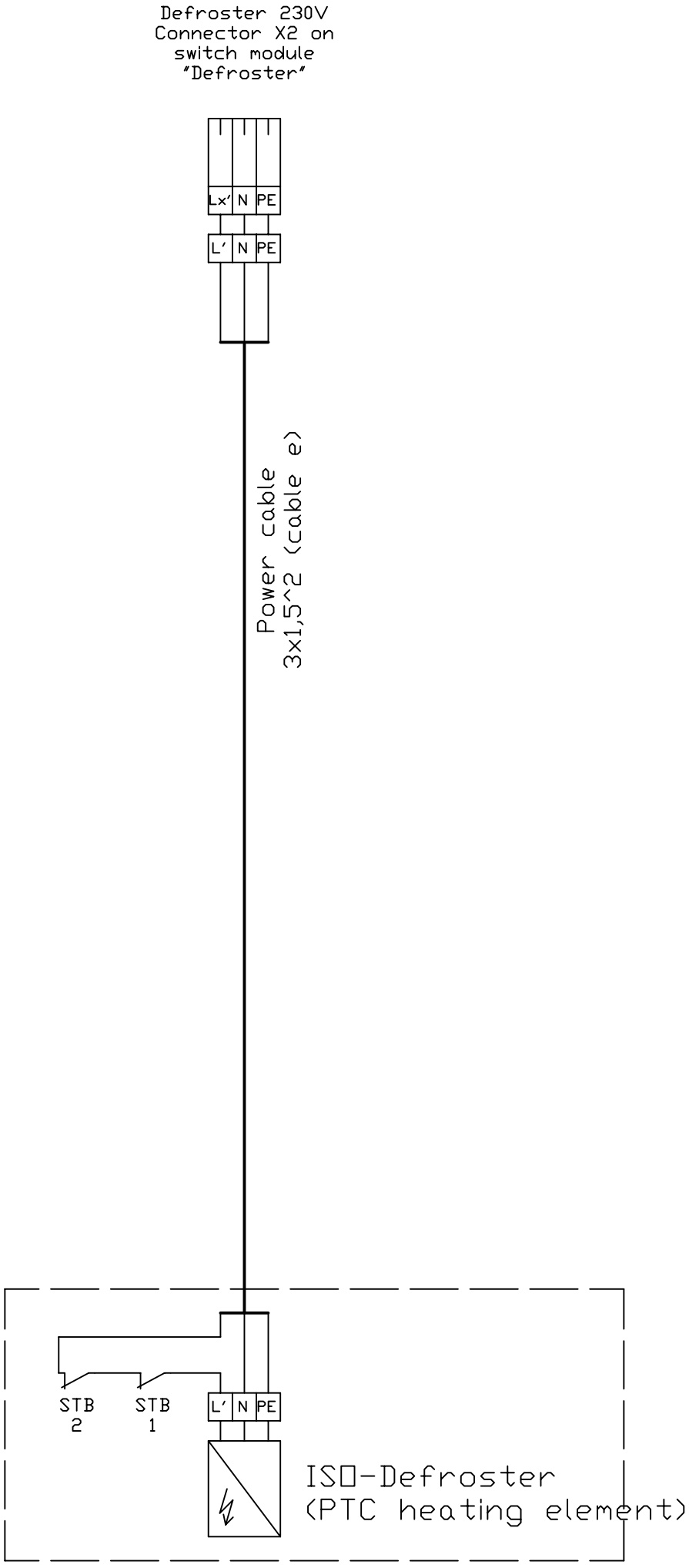
Appendix 4.4.b Cabling of ISO duct heater with PTC heating element



Appendix 4.5 Cabling of flow sensors

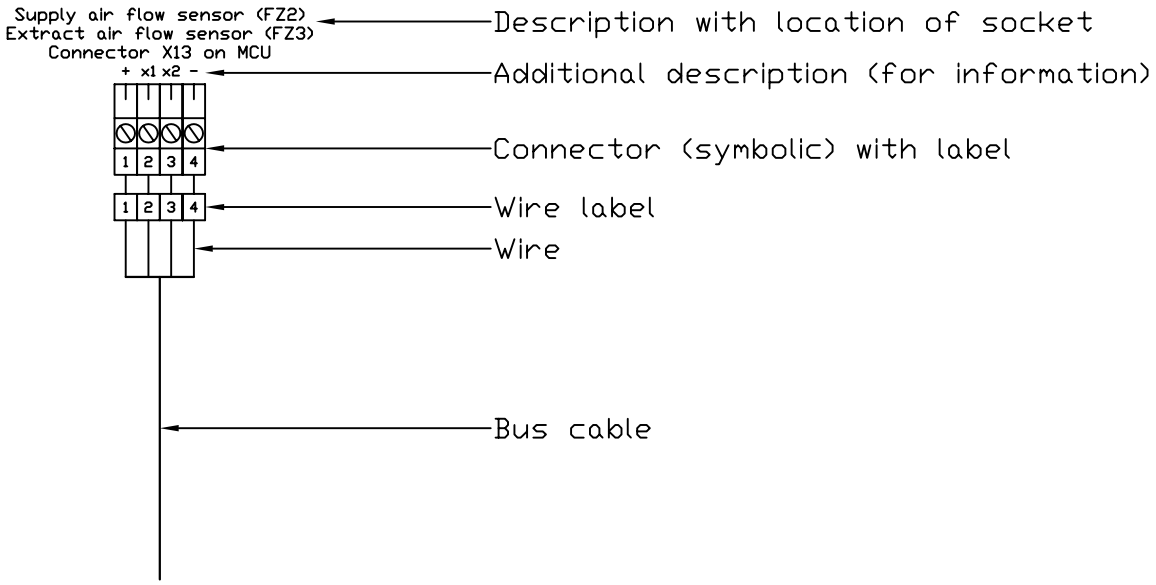


Appendix 4.6.a Cabling of frost protection heater with ohmic heating element



Appendix 4.6.b Cabling of ISO frost protection heater with PTC heating element

Legend



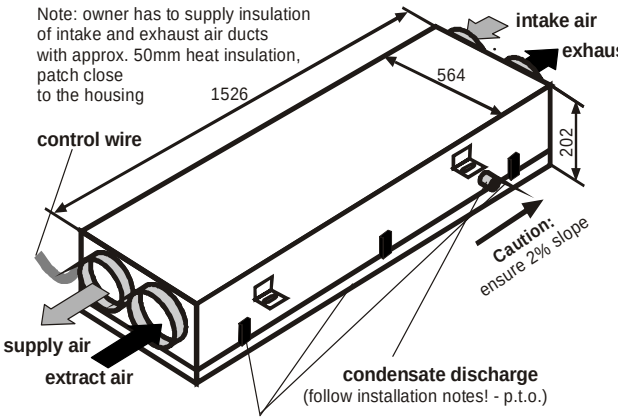
Abbreviations:
MCU: Main Controller Unit (mainboard on the left)

Power pack board (mainboard on the right)

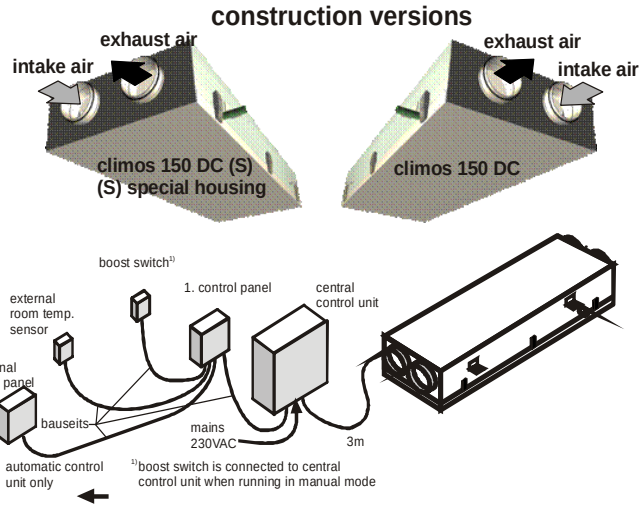
Switch modules:
Defroster
Duct heater
Heating element
Solar system
Heat pump module

Status 27.08.09 We reserve the right to make changes favouring technical progress.	**Technical Data** **Mechanical Ventilation Heat Recovery Unit** **climos 150 DC (S)** **false ceiling unit**	PAUL WÄRMERÜCKGEWINNUNG

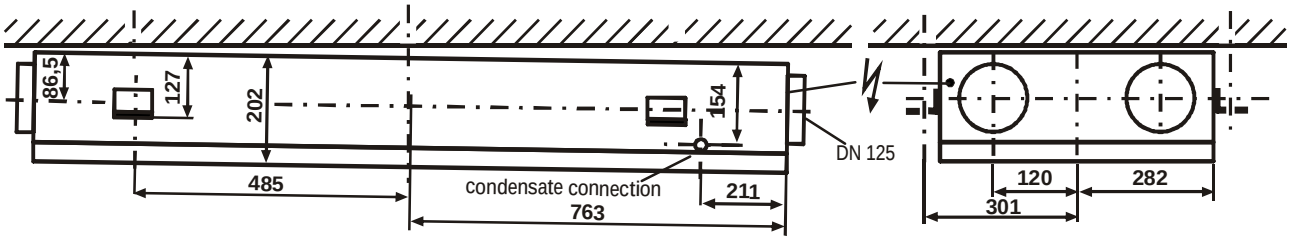
Structure / construction versions:



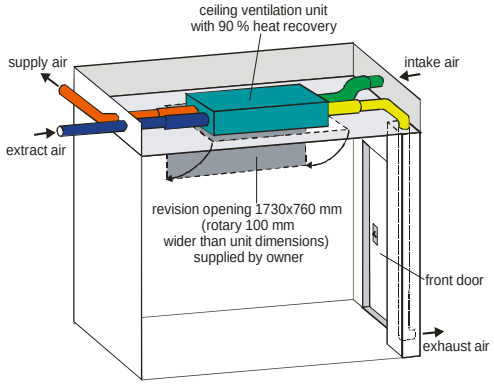
- spring locks (3 pcs.)
- hinge on site without condensate discharge
- mean hinge with self-locking bolt



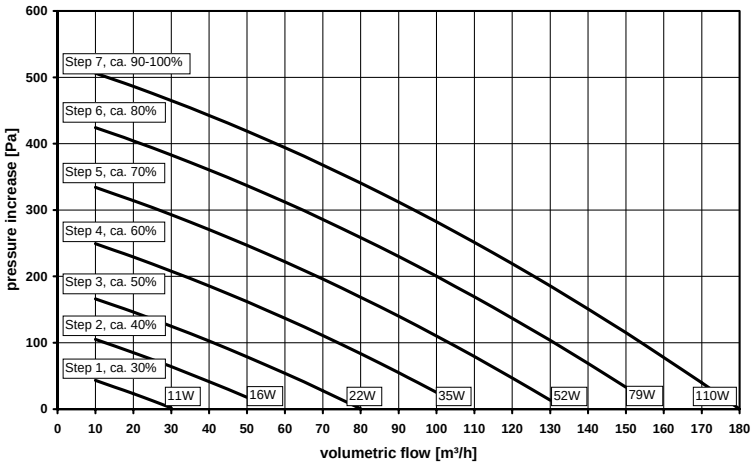
Overall Dimensions:



Mounting Position:


ceiling ventilation unit with 90 % heat recovery
supply air
intake air
extract air
revision opening 1730x760 mm (rotary 100 mm wider than unit dimensions) supplied by owner
front door
exhaust air

Characteristic:



Notes:

- An access panel , covered with 12,5 mm plasterboard, for false ceiling installation can be optained from Paul Wärmerückgewinnung GmbH (mounting dimension: 1630 x 700 mm; weight: 10 kg; spring locks as closing elements).
- Revision opening (min. 1630 x 700 mm) for maintenance and filter change is necessary when installing the MHVR in false ceiling..
- We recommend using a dry-syphon when installing MVHR in false ceiling.
- Install the control unit in a way to ensure there is no heat build-up and sufficient space for service access.
- Install the MVHR unit upright in a frost-free place, preferably > 10°C.
- Do not lay control cables for programmers and sensors in parallel to 230/400 VAC cables (minimum distance of 20 cm) and do not lay out cables in loops.
- Simultaneous fireplace operation is possible via an **extra module for negative pressure monitoring** with a shut-down function for the ventilation unit and/or the exhauster hood connected to the exhaust air duct.

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MVHR components:

Components suitable for Passive House Dr. Wolfgang Feist

Heat exchanger:	Material: HX plastic
Fans:	48 V DC (DC radial fan)
Filters:	Filter class: G 4 (supply/extract air) Option: pollen filter F 8 (supply air) – higher pressure loss
Central control unit:	
(for option 1)	Lx Wx D (mm): 340x 300x 80
with defroster and backup duct heater option	Lx Wx D (mm): 340x 300x 140
(for option 2)	Lx Wx D (mm): 340x 300x 80
Housing:	Galvanized steel plate, no thermal bridges, 40 mm heat insulation, sound-insulated
Duct connections:	diameter 125 mm nipple measure
Condensate drain:	hose ¾“ (syphon – supplied by customer)
Weight:	45 kg
Electrical connection:	230 V, 50 Hz, pre-wired
Protection class (acc. to EN 60335)**:**	I
International protection (acc. to DIN 40050)**:**	IP 41 (MVHR) IP 20 (Control unit)
Cable length:	- mains cable: (by customer) - between MVHR and central control unit: 3 m - between central control unit and control panel: max. 15 m, (4-wire, screened control wire IYSTY 2x2x0,6), supplied by customer
Operation limit:	max. 40°C
Mounting position:	horizontal, 2 % slope to condensate drain

Operating data:

Power input:	max. 110 W
Volumetric flow rate:	30 to 180 m³/h - 150 m³/h (at 100 Pa)
Heat recovery rate:	approx. 80 to 95 %

Sound pressure level
Acc. to DIN EN ISO 3743-1**:**

Fan stage / control	3m distance in free field	With installation in intermediate cover Acc. to DIN 4109 Bbl. 1Tab. 26
Step 1 ca. 30%	23 dB(A)	< 20 dB(A)
Step 3 ca. 50%	27 dB(A)	
Step 5 ca. 70%	32 dB(A)	
Step 7 ca.100%	33 dB(A)	

Control:

Option 1: Automatic control
Standard functions

- 8 independent time programs can be defined and assigned to any day of the week
- Manual adjustment of ventilation steps (off, minimum,normal,maximum)
- Control panel can be installed in any place in the house
- Ventilation steps programmable in 1% increments (30-100 % of maximum fan power)
- Adjustable balance between supply and extract air fans
- Filter monitor for change interval
- Freeze protection for downstream hot water duct heater
- Manual stop in standby mode with limited power input below 2 W

Options (available at extra cost)

- Control of an electric valve (direct air intake or via ground heat exchanger) or a brine-defroster (brine/air-heat exchanger for ext. air conditioning)
- Control of a frost protection pre-heater (frost protection heater prevents ice formation and replaces a ground to air heat exchanger in winter)
- Constant flow control (permanent monitoring and balancing of the supply and extract air flows, fireplace compliant)
- Control of a heating circuit (e.g. heating circuit pump or electric back-up duct heater up to 2.1 kW) – also with night economy
- Several boost switches can be connected to the control panel
- The MVHR unit can be operated by several programmers (e.g. one in the place of installation, another one in the living room). If a duct heater is used, the room temperature is recorded at the first control panel

Option 2: Manual control

- 7-leve fan speed control with OFF-function
- Rapid ventilation possible
- Possibility to connect additional, external boost switches
- External OFF-contact
- Clock timer for any day of the week (optional)
- Fireplace compliant (optional – additional configuration software)
- Balance adjustable between supply air and exhaust air fans
- „**supply air only**“ or „**exhaust air only**“ (summer adjust.)
- When fireplace compliant „**exhaust air only**“ locked
- Filter monitor for change interval
- Frost protection:
  a) Stepless reduction of supply air fan speed (not when fireplace compliant) when exhaust air temperature < 2°C
  b) Frost protection heater with independent control (optional)
  c) Ground heat exchanger (optional)

Control units:

Comfort control unit
For automatic control
(LxBxT in mm: 158x125x32)
Cable: IYSTY 2x2x0,6,
max. 15 m, by customer

Membrane keypad
For manual control
(LxBxT in mm: 80x80x12)
Cable: IYSTY 2x2x0,6,
max. 15 m, by customer

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Status: 27.08.09 Subject to change in the interest of technical progress.	**Checklist A for maintenance work by the owner / user**	PAUL WÄRMERÜCKGEWINNUNG

maintenance work				
1. change both filters in the WRG device: Enter the date every quarterly				
Quarterly / Year	**I**	**II**	**III**	**IV**
200...				
201...				
201...				
201...				
201...				
2. Clean filters in exhaust air valves: Enter date every quarterly				
Quarterly / Year	**I**	**II**	**III**	**IV**
200...				
201...				
201...				
201...				
201...				
3. Change pre-filters in fresh air pipe (Suctioning in of outside air – also in the soil heat exchanger)				
Quarterly / Year	**I**	**II**	**III**	**IV**
200...				
201...				
201...				
201...				
201...				
4. Exhaust hood - Clean grease filters every 6 -8 weeks with hot water for rinsing - Change activated carbon filter (only in the case of a circulating air hood) every 4 months				
Quarterly / Jahr	**I**	**II**	**III**	**IV**
200...				
201...				
201...				
201...				
201...				

Simplified formula for determining heat recovery rate η:

$\eta = \frac{t_{SUP} - t_{INT}}{t_{EXT} - t_{INT}}$	**Legend:** t_{INT} - Intake air temperature t_{EXT} - Extract air temperature t_{SUP} - Supply air temperature	**Note:** The air temperatures are to be measured in the center of the air lines at the equipment!

Notes: The warranty expires, if

- filter change is made not at least within the double standard time specified above
- no original PAUL filters are used

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Status: 27.08.09 Subject to change in the interest of technical progress.	**Checklist B for maintenance work by technical staff**	PAUL WÄRMERÜCKGEWINNUNG

Maintenance work

- Inspection of the ventilation unit every 2 years as per DIN 1946/Part 6 Pt.6 and DIN 1946/Part 2, Pt.7 as per. VDI 6022 (4/2006) point 5.3.2 must take place hygiene inspections with RLT plants without humidification in the distance from 3 years (… with humidification every 2 years)
- Please enter: Year, Date, Name
- Remarks on condition → informal record

	201...	201...	201...	201...	201...
1. Clean heat exchanger with warm water < 50°C and washing-up liquid – in case of calcification: vinegar solution Air-to-air heat transducers are as per DIN 1946/6 to clean (point 12,3 (3)) annually					
2. Check all filters for contamination, moisture, tightness and corrosion; replace where necessary					
a in the MVHR unit					
b at outdoor air intake (pre-filter – e.g. gable wall or ground heat exchanger)					
c at extract air valves					
d check filter change intervals by inspecting the records of the tenant / owner					
e record any filter change in writing					
3. Check intake air ducts for contamination on a random basis (also in the ground heat exchanger)					
4. Check silencers / sound attenuators					
a at the MVHR unit					
b in the ventilation system (if accessible)					
c at overflow passages/openings (e.g. doors, partition walls) (if any)					
d clean where necessary					
5. Check duct heaters (frost protection and back-up duct heater)					
a clean to remove dirt where necessary					
b functional check					
c Thermal protection switch function					
d check heat insulation (visual)					
6. Check valve settings (air flow rate)					
a as projected					
b or according to different user experience					
7. Clean valves					
8. condensate drain (U bend clogged?) check water level in U bend					
a condensate pan					
b Condensate drainage (siphon clogs?) Water filling in the siphon examine					
c Water inlet (if available)					
9. Check airtightness in MVHR unit					
a pull the mains plug					
b disconnect the extract air fan electrically (put it out of circuit)					
c disconnect the extract air duct from the MVHR unit.					
d connect the mains plug & switch on the intake air fan					
e Exhaust air duct from the MHRV unit separate					
f Power supply plugs attach + fresh air fan switch on					

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g	in the ventilating outlet no air movement may be noticeable - inspection result					
h	Bypass slidegate valve tightness (in WT-box remove heading) only with type „ther-mos “					
10.	Check:					
a	electrical connections (contacts)					
b	fan control					
c	boost switch					
d	filter indicator					
e	other control equipment					
f	clean flow sensors					
g	fan speed balance VSUP = VEXT					
h	Differential pressure guard, annually					
11.	Check ventilation fans					
a	bearing noise (charred grease)					
b	imbalance					
12.	Check ventilation system for tightness and corrosion (visual examination)					
a	assembly joints					
b	flexible lines					
13.	Check insulation (visual examination)					
a	damage					
b	moisture penetration					
c	connection point at MVHR unit					
d	line to valve connection					
14.	Check fire dampers (if any)					
a	inspect test report					
b	latch and trigger mechanism; check for contamination and reversible function					
c	change trigger element and check for smooth action					
d	functional check of position indicator					
15.	Measurements and recording of measured data					
a	power input of MVHR unit (without heating) at operating speed					
b	temperature at MVHR duct socket: • intake air • supply air • extract air • exhaust air					
c	temperature at - supply air valve - exhaust air valve					
16.	Maintenance cost & expenses					
a	maintenance [h]					
b	hourly rate [€/h]					
c	a x b [€]					
d	mileage actually run					
e	mileage allowance [€/mile]					
f	d x e [€]					
g	travel time					
h	hourly rate for travel [€/h]					
i	g x h					
k	total: c + f + i					
Monthly charge [€/month] for 2-year interval						

The following maintenance items are compulsory:
1, 2, 3, 5, 7, 8, 10, 14 (for multi-family houses), 15, 16 = simple maintenance

Status: 27.08.09 Subject to change in the interest of technical progress.	**Air Flow Report** **Operating condition, functional check[1)], instruction**	PAUL WÄRMERÜCKGEWINNUNG

Costumer data:		
Surname:	First name:	Tel:
Street:	ZIP:	town:
Construction project:		

MVHR-type:	serial no.:	control no.:

measuring equipment used:	fault description during measurement:	indoor temperature [2)]:
		outdoor temperature [2)]:
		weatherr [2)]:

filter condition on calibration	supply air	extract air		fan speed ratio extract/supply air:
clean				
used for approx. ... days				.....
very dirty				

supply air				ventilation step: %	
Nr.	room description	projected data m³/h	projected data m³/s	measured data m³/h	measured data m³/s

extract air				ventilation step: %	
Nr.	room description	projected data m³/h	projected data m³/s	measured data m³/h	measured data m³/s

P_{el} = W (2 fans)

MVHR control system has been checked

[1)] The volumetric air flow is measured during normal MVHR operation 3) as agreed.
[2)] acc. to DIN EN 14134, Item 7.3.1.5.
[3)] acc. to DIN EN 14134, Item 7.4.1. b) end
[4)] acc. to DIN 1946-6 MVHR unit has to run continuously, except for times of maintenance or repair. Use lowest ventilation step or intermittent holiday program in times of absence.

⇨ The user has been instructed on the hygienic requirements[4)] for the operation of the MVHR unit
⇨ Customer has been advised that winter and summer operation influence the interior air humidity
⇨ No parts other than genuine PAUL parts (e.g. filters) shall be used, otherwise the warranty will be void
⇨ The warranty period starts with the startup of the system

Date: ..... Signatures: .....
startup personnel user

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